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Region 2 RAC2
Remedial Action Contract

Revised Final Feasibility Study

Matteo & Sons, Inc. Site, OU1

Remedial Investigation/Feasibility Study

Thorofare, New Jersey

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CDM Smith

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Acronyms

µg/dL	micrograms per deciliter
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CAMU	Corrective Action Management Unit
CDM Smith	CDM Federal Programs Corporation
CEA	classification exception area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSM	conceptual site model
CTE	central tendency exposure
CY	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
ESL	ecological screening level
FEMA	Federal Emergency Management Agency
FS	feasibility study
GRA	general response action
GWQS	(NJDEP) Groundwater Quality Standards
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IGW	impact to groundwater
LDR	land disposal restriction
LOAEL	lowest observed adverse effect level
Louis Berger	The Louis Berger Group, Inc.
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	mean lower low water
MNA	monitored natural attenuation
MNR	monitored natural recovery
msl	mean sea level
MTR	minimum technology requirements
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/kg	nanograms per kilogram
NJDEP	New Jersey Department of Environmental Protection
NOAEL	no observed adverse effect level
NRDCSRS	non-residential direct contact soil remediation standard

O&M	operation and maintenance
OU	operable unit
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PDI	pre-design investigation
PEM1	palustrine emergent, persistent wetlands
PFO1	palustrine forested broad-leaved deciduous wetlands
ppm	part per million
PRG	preliminary remediation goal
PRM	Potomac-Raritan-Magothy
PSE&G	Public Service Electric & Gas
R1EM	riverine tidal emergent wetlands
R1OW	riverine tidal open water
RAGS	Risk Assessment Guidance for Superfund
RAO	remedial action objective
RASE	remedial action selection evaluation
RCRA	Resource Conservation and Recovery Act
RDCSRS	residential direct contact soil remediation standard
REAC	Response Engineering and Analytical Contract
RI	remedial investigation
RME	reasonable maximum exposure
S/S	solidification/stabilization
SLERA	screening level ecological risk assessment
SRI	supplemental remedial investigation
SVOC	semivolatile organic compound
T/M/V	toxicity, mobility, or volume
TAL	Target Analyte List
TBC	to be considered
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TEQ	toxicity equivalent
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
UCL	upper confidence limit
UHC	underlying hazardous constituent
USFWS	United States Fish and Wildlife Service
UTS	universal treatment standards
VOC	volatile organic compound

Executive Summary

Introduction

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 032-RICO-02KD under the United States Environmental Protection Agency (EPA) Region 2 Remedial Action Contract No. EP-W-09-002 to perform a remedial investigation (RI)/feasibility study (FS) for the Matteo & Sons, Inc. Superfund Site (the site) located in Thorofare, West Deptford Township, Gloucester County, New Jersey.

The site has been divided into three operable units (OUs). OU1 addresses the source materials, soil contamination, and groundwater contamination at the Matteo & Sons, Inc. property, Mira Trucking property, and the Willow Woods community neighboring the site. OU2 focuses on the residential properties located at Tempo Development. OU3 addresses the contaminated sediment and surface water. The EPA RI was performed prior to the division of OUs and collected data for both OU1 and OU3. These data are discussed below and used to develop the conceptual site model in Section 1. OU1 of the site is referred to as "the study area" in this FS. This FS is prepared for OU1.

Site Location and Description

The Matteo Study Area is located at 1708 U.S. Highway 130 (1692 Crown Point Road) in Thorofare, West Deptford Township, Gloucester County, New Jersey. The study area consists of the Matteo property, nearby properties (Willow Woods, former Billy-O-Tire, and Mira Trucking), and portions of Hessian Run and Woodbury Creek. The study area has been divided into several areas based on site physical features, historical information, and the locations of samples collected during the RI and previous investigations. These areas are described below.

- Matteo property – 82.5 acres of contiguous upland areas and adjacent mudflats located between the confluence of Woodbury Creek, Hessian Run, and U.S. Highway 130. The Matteo property includes the scrapyard area, the open field/waste disposal area, and the rental home area.

  - Scrapyard area – The southeastern portion of the Matteo property that supports the active scrap metal recycling business is approximately 10 acres and largely paved or covered with crushed stone.

  - Rental home area – This 2.3-acre property with a rental home owned by Matteo is separated from the Matteo scrapyard area by a chain-link fence and gate.

  - Open field/waste disposal area – This area is 53 acres and comprised primarily of heavily vegetated, undeveloped land, including several distinct waste disposal areas that were delineated during previous New Jersey Department of Environmental Protection (NJDEP) RI investigations.

- Tidal mudflats – The Matteo property also includes approximately 17.2 acres of tidal mudflats within Hessian Run that are below water at high tide.

- Willow Woods property – A manufactured home community (approximately 14.5 acres) adjacent to the southwestern border of the Matteo property.
- Woodbury Creek – A primary tributary of the Delaware River, which is south of the Matteo property, with deep narrow channels (up to 12 feet below sea level) and extensive tidal flats along its northern and southern shores.
- Hessian Run – A tributary of Woodbury Creek adjacent to the northern boundary of the Matteo property with its furthest upstream reaches just east of U.S. Highway 130. Hessian Run is made up primarily of extensive tidal flats (mud flats) with small shallow channels (less than 2 to 3 feet below sea level) extending through the flats.
- Former Billy-O-Tire property – A former truck and auto repair shop (approximately 1 acre) located between the Matteo property and the Willow Woods property.
- Mira Trucking – A 4-acre property used for staging large trucks located on the opposite side of Crown Point Road from the Matteo property. After it was reported that the property may have been used for Matteo site operations, EPA performed sampling on the property in two phases completed in November 2017 and December 2018. In April 2018, several adjacent residential properties were sampled, including the residence immediately west of the Mira Trucking property identified as property P002. The findings from these investigations are summarized in the Matteo OU1 RI addendum (CDM Smith 2019).

Site History

The Matteo property was owned between 1907 and 1947 by Samuel and Bertha Wilkins who used a portion of the property for farming activities; the remainder of the site was covered by woodlands. The Matteo family acquired the property in 1947 and has operated an unregistered landfill, junkyard, and metals recycling facility at the site since 1961. In 1968, NJDEP identified an inactive incinerator at the site.

From 1968 through 1984, NJDEP conducted several inspections and issued an Administrative Order on Consent for solid waste violations in January 1984.

From 1996 to 2005, NJDEP collected extensive data to characterize site contamination and conducted an aquatic biota study to assess potential biological impacts of lead and polychlorinated biphenyl (PCB) contamination in sediment, surface water, and soils to justify a removal action.

In 2005 and 2006, EPA collected soil samples to confirm the presence of lead and PCBs in soil within the Matteo property and the Willow Woods Manufactured Mobile Home Community.

On September 27, 2006, the site was listed on the EPA National Priorities List.

EPA Remedial Investigation

The initial EPA RI field investigations were conducted between September 19, 2011 and February 7, 2012. The fieldwork included a surface water and sediment investigation, a soil investigation, a groundwater investigation, a bathymetric survey, a hydrogeological assessment, and a cultural resources survey. Following the completion of the 2012 field investigation, EPA found that the analytical results of volatile organic compounds, semi-volatile organic compounds, pesticides, and PCBs were determined to be of unreliable quality. CDM Smith conducted additional sampling of soil and groundwater from the same locations from December 2014 to March 2015 to replace the earlier unreliable data set. In this report, only data considered valid and reliable are used, and such data from both investigation events are referred to as the EPA RI data.

During the 2016 OU2 investigation of the 36 single-family residential properties located in and adjacent to the Tempo Development on Woodline Drive, Birchly Court, Oakmont Court, Hessian Avenue, and Crown Point Road, a resident informed EPA that dumping may have occurred at the Mira Trucking property as part of Matteo operations. To evaluate the extent of battery casings and soil contamination, Weston Solutions, Inc., on behalf of EPA, performed field investigations of the Mira Trucking property and several surrounding residential properties in two phases completed in November 2017 and December 2018. An additional investigation was performed at the residential properties adjacent to the Mira Trucking property, including residential property P002 in April 2018.

Additionally, in November 2018, CDM Smith collected two additional samples from the potable well on the rental home property. The findings of the Mira Trucking sampling and rental home potable well sampling are summarized in the Matteo OU1 RI addendum (CDM Smith 2019).

Physical Setting

Topography and Drainage

The site is located within New Jersey's Coastal Plain Physiographic Province at an average elevation of approximately 10 feet above mean sea level (msl). Most of the site is unpaved and heavily wooded, with an overall slope toward the west/northwest and radially in the direction of Woodbury Creek and Hessian Run. The scrapyard area is the topographic high point, with an elevation of approximately 25 feet above msl. The site is situated at the confluence of Woodbury Creek and Hessian Run, which are part of the Delaware River basin. Runoff from the scrapyard area and the open field/waste disposal area flows north/northeast, through and over areas where waste and battery casings were landfilled, into Hessian Run. Runoff from the western area of the site primarily flows west into Woodbury Creek.

Geology and Hydrogeology

Three geologic units were encountered at the site; from shallow to deep, they are the Cape May Formation, the Merchantville Formation, and the Magothy Formation. The Merchantville Formation is considered an aquitard. It is encountered beneath the Cape May Formation in the eastern and southern portions of the site where it is approximately 20 feet thick. The formation thins and eventually pinches out in the western portion of the site. The Magothy Formation extends at least to the maximum drilled depth (approximately 100 feet below ground surface [bgs]).

Two groundwater flow systems are present at the site—a shallow perched flow system and a deep regional flow system. The perched flow system is observed from approximately 5 to 14 feet bgs. The extent of this perched water zone mirrors the extent of the Merchantville Formation. Generally, the perched groundwater flows radially away from the topographically elevated scrapyard area. In the extreme eastern portion of the site and along the northern shoreline, the perched groundwater flows north discharging to Hessian Run; the remainder flows toward the topographically lower western portion of the site where the Merchantville Formation is absent.

The deep regional flow system is described as a single hydrologic unit, referred to as the Potomac-Raritan-Magothy (PRM) aquifer system. The average horizontal hydraulic conductivity in the PRM is 13.6 feet/day. The regional deep groundwater flows to the southeast. The wells at Matteo facility and the rental home currently pump water from this deep aquifer.

Tidal Influence

The tides vary substantially throughout the year. Peak high tides occur in the spring, reaching 7.6 feet above mean lower low water (MLLW). Tidal elevations then drop, bottoming out in late summer, and then climb to a second, less pronounced peak around October. Finally, the lowest low tides occur in the winter, between January and February, with low tides nearly a foot below MLLW. The greatest disparity between low tide and high tide tends to occur in the spring, between March and June. These tidal water levels and seasonal fluctuations need to be considered in the design and implementation of the remedial action in OU1.

Groundwater/Surface Water Interaction and Tidal Influence

Water level data, tidal fluctuations in Hessian Run, and data from synoptic groundwater level monitoring events were used to further define the relationship between surface water and groundwater as described below.

- The surface water tidal fluctuations have minimal influence on the shallow perched groundwater levels. The shallow perched groundwater discharges laterally to Hessian Run or toward the western portion of the site into the regional aquifer where the Merchantville Clay is absent.

- Seeps are present along the shoreline at low tide in areas where the land surface slopes into both Hessian Run and Woodbury Creek.

- The deep regional groundwater levels below the confining layer (Merchantville Formation) showed a small response to surface water tidal changes, suggesting these systems are hydraulically connected, likely in the area where the Merchantville Formation ends. This and the high vertical gradients across the confining layer suggest that the deep zone to the east is confined.

- The surface water bodies are gaining streams in the areas where the Merchantville Formation is present and the perched groundwater elevations are above the creek elevations. To the west, the creeks feed the regional aquifer as groundwater elevations are below the surface water elevations. In the western portion of the site where the Merchantville Formation is absent, there is a transition zone where the shallow perched groundwater discharges to the regional aquifer.

Floodplains and Wetlands

- The western portion of the site, more than half of the Matteo property, is within the Federal Emergency Management Agency Special Flood Hazard Area, subject to inundation by the 100-year flood.
- Four types of wetland habitat were observed and delineated within the site, including riverine tidal emergent wetlands (R1EM), palustrine emergent, persistent wetlands (PEM1), palustrine forested broad-leaved deciduous wetlands (PFO1), and riverine tidal open water (R1OW).

Nature and Extent of Contamination

The nature and extent of contamination in site media was assessed by comparing RI results to the lower of the site-specific human health or the site-specific ecological screening criteria. Lead, antimony, copper, zinc, and PCBs were identified as site-related contaminants in the final RI report (CDM Smith 2018a) because these compounds are related to past site operations and exceed screening levels and local background levels.

Source Materials

Battery casings and municipal waste mixed with battery casings originally placed along the shore of Hessian Run act as the source of lead contamination to surface soil, subsurface soil, and sediment. The extent of battery casings and waste mixed with battery casings on the Matteo property was delineated during the NJDEP RI. In addition, the soil immediately beneath the battery casings and waste mixed with battery casings was also found to contain high lead concentrations due to the leaking of acid and lead containing chemicals from the battery casings. Furthermore, the sediment adjacent to the battery casings disposal area also contains scattered battery casings and high concentration of lead. Battery casings were also identified at the Mira Trucking property during the 2017 and 2018 EPA investigations. The battery casing material was found to contain high lead concentrations and was identified as the source of lead contamination in soil at the Mira Trucking property.

Principal threat wastes are identified by the NCP (40 CFR 300.430) as source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. For this site, the battery casings exhibit elevated concentrations of lead and are characteristically hazardous (D-008 for lead). Collectively, battery casings mixed with municipal waste, soil, and sediment are considered source materials because these materials serve as a continued source of contamination to soil, sediment, and potentially groundwater through wind entrainment, stormwater runoff, inundating tidal water, and infiltration from precipitation. Therefore, these source materials are considered principal threat waste.

Summary of Soil Contamination

- In the open field/waste disposal area and the scrapyard area, the majority of lead contamination exceeding the non-residential direct contact soil remediation standard (NRDCSRS) of 800 milligrams per kilogram (mg/kg) is concentrated in the upper 4 feet of soils in and near the scrapyard area and is directly associated with the waste disposal areas along the shoreline of Hessian Run. The highest lead concentration in soil was 94,100 mg/kg at 2 to 4 feet bgs near the former incinerator. In the 4- to 8-foot bgs interval, lead contamination exceeded NRDCSRS at two locations immediately adjacent to the battery casing disposal areas. In the 8- to 12-foot bgs interval, lead was below the NRDCSRS but exceeded the NJDEP impact to groundwater (IGW) criterion of 90 mg/kg at one location near the former incinerator; none of the other deep soil samples exceeded the IGW criterion.

- Residential areas (Willow Woods and the rental home area): Sampling following the EPA removal action at the Willow Woods property detected lead below the NJDEP Residential Direct Contact Soil Remediation Standard (RDCSRS) of 400 mg/kg. However, one location containing lead above the RDCSRS below a manufactured home was unable to be excavated during the removal action. The area was capped with 4 inches of concrete and no longer poses an exposure risk to residents. At the rental home area, lead exceeded the RDCSRS in only one sample.

- Elevated concentrations of antimony, copper, and zinc were generally colocated with the lead contamination in the upper 4 feet of soils in the scrapyard area, whereas only antimony was elevated in the waste disposal areas. This pattern suggests that lead, antimony, copper, and zinc were related to the metal reclamation processes in the scrapyard area.

- Elevated concentrations of PCBs were found in the scrapyard area and in the open field/waste disposal area, with the majority of contamination in the upper 4 feet. High PCB concentrations greater than 200 mg/kg were detected at two locations, one in the scrapyard between ground surface and 4 feet bgs and one in the open field/waste disposal area between 4 and 8 feet bgs.

- Concentrations of lead greater than 800 mg/kg are widespread throughout the Mira Trucking property in the 0- to 1-foot bgs interval. Concentrations of lead greater than 800 mg/kg were typically colocated with the presence of battery casing material, and the concentrations generally decrease with depth. Concentrations of antimony, arsenic, and PCBs greater than the NRDCSRS were found colocated with lead concentrations greater than the NRDCSRS. In addition, lead concentrations were greater than 400 mg/kg in the northeastern corner of the residential property P002, immediately west of the Mira Trucking property.

Summary of Sediment Contamination

- Lead, antimony, copper, and zinc contamination is generally concentrated in the upper 3 feet of sediment immediately adjacent to battery casing disposal areas. Lead was detected as high as 6,430 mg/kg (T14-E from 0 to 0.5 foot), antimony at up to 37.2 mg/kg (T9-E from 0 to 0.5 foot); copper at up to 195 mg/kg (T14-E from 1 to 1.5 feet below the sediment surface); and zinc at up to 1,750 mg/kg (T7-E from 0 to 0.5 foot) (CDM Smith 2018a).

- PCBs, primarily Aroclor 1254, were concentrated in the upper 3 feet of sediment throughout both Hessian Run and Woodbury Creek. Aroclor 1254 was detected up to 19,600 micrograms per kilogram (μg/kg) during the NJDEP RI and up to 850J μg/kg during the EPA RI. While the most elevated concentrations are immediately adjacent to the site within Hessian Run, the distribution throughout the drainage basin is more varied.

Summary of Seep/Sediment Porewater Contamination

- Site-related dissolved metal contaminants (lead, copper, antimony, and zinc) were observed in seep and porewater samples adjacent to the battery casing disposal areas. In seep samples, total lead was detected at up to 251,000J micrograms per liter (µg/L), whereas dissolved lead was detected at up to 802 µg/L. In porewater samples, total lead was detected at up to 11,100 µg/L, whereas dissolved lead was detected at up to 456 µg/L.

- Concentrations of Aroclor 1254 also exceeded the RI screening criterion, reaching 0.62J µg/L in seep samples and 1.1 µg/L in sediment porewater samples.

Summary of Surface Water Contamination

- Surface water sampling found limited exceedances of screening criteria for the site-related contaminants lead and copper, with the highest being in a background sample location. The highest total lead concentration adjacent to the battery casing disposal areas was 7.1 µg/L. Dissolved lead concentrations were all below surface water criterion, indicating the lead was associated with the suspended solids in the surface water samples.

Summary of Groundwater Contamination

- Total lead concentrations exceeded the groundwater screening criterion of 5 µg/L at five wells, whereas dissolved lead only exceeded the criterion at one well within a battery casing disposal area, with total and dissolved lead concentrations as high as 573J and 43.3 µg/L, respectively. Compared to the lead levels observed during the NJDEP RI, lead concentrations have significantly decreased.

- Antimony exceeded the groundwater screening criterion of 6 µg/L at one well not located within the battery casing disposal areas.

- Tetrachloroethene, trichloroethene, and vinyl chloride were detected in site monitoring wells but are not site-related contaminants and are likely originating from off-site contaminant sources.

- The three potable wells on or adjacent to the site (located at the rental home, the Matteo scrapyard weigh station, and the former Billy-O-Tire) do not appear to be affected by site-related contaminants as only aluminum and sodium were detected above the New Jersey Drinking Water Standards.

Conceptual Site Model

Two groups of contaminants are related to past site operations: metals (lead, copper, antimony, and zinc) and PCBs. Historically, the on-site incinerator reclaimed lead and copper from automotive batteries (lead-acid batteries) and recycled wire. Crushed battery casings and ash from the incinerator were disposed of along the shoreline of Hessian Run. The improper handling and disposal of lead-acid batteries was the source of metal contamination. PCB contamination was widespread in the open field/waste disposal areas, along the unpaved road, and in some of the scrapyard and battery casing disposal areas. The distribution and types of PCBs suggest widespread application of a PCB-containing product, possibly for dust and weed control. PCBs are extremely insoluble and have strong affinities for soil and sediment, making them relatively immobile and persistent in soil and sediment for a long time. Physical transport (e.g., erosion) is expected to be the primary transport mechanism for PCBs.

The lead-acid batteries usually contained elemental lead, lead oxide, lead sulfate, and dilute sulfuric acid solution. Improper handling of batteries in the crushing operation would have released lead sulfate and sulfuric acid onto the ground surface. The acid would be neutralized gradually as it infiltrated downward into soil. Where the acid reacted with the soil or scrap metal on the ground surface or metal-containing waste, the low pH would have increased the solubility of metals or dissolved the metals, resulting in migration of metals into surface soil and subsurface soil. In a lead-acid battery, lead sulfate would approach its solubility in the dilute sulfuric acid. Once the soluble lead sulfate was released to the soil, the pH would increase, and lead sulfate would precipitate. Therefore, most of the lead contamination would be retained in the shallow soil. At locations with relatively large quantities of released acid, lead and other metals would have infiltrated to deeper depths. The RI data demonstrated that the majority of lead contamination was found from 0 to 2 feet bgs, whereas lead had migrated at a few locations to deeper depths.

The improper disposal of crushed battery casings along Hessian Run has contaminated the soil, sediment, perched groundwater, and surface water in direct contact with the acidic lead-containing waste. However, the battery casing waste was situated on top of silt and clay materials, which would limit the vertical migration of metal contamination.

Surface runoff during storm events and tidal flows are believed to have played an important role in contaminant transport, especially during the early stages of waste disposal along Hessian Run. Erosion of battery casing waste spread the battery casings upstream and downstream from the disposal areas in Hessian Run. However, a review of vertical lead distribution data in the northern portion of Hessian Run indicates deposition of less contaminated sediment in some areas of the mudflats.

Infiltration water in contact with the battery casing disposal areas and the perched groundwater flow through the battery casing disposal areas have been contaminated with metals (such as lead) and discharged to Hessian Run as seeps during low tide. In addition to migration in the dissolved phase, metal contaminants have also migrated to the Hessian Run mudflats as suspended solids in the seeps; this is considered to be a major ongoing pathway for contaminant transport. The migration of metals at high concentrations into the mudflats was found to be at a limited distance along the bank of Hessian Run, which may be related to the low flow rates of tidal water and settlement of suspended solid near the bank of Hessian Run. It should be noted that during major storm events, both flow rates of tidal water and surface runoff are anticipated to be much higher than normal, which may cause redistribution of contaminants in Hessian Run mudflats.

Mira Trucking was used in some capacity for lead reclamation activities associated with the Matteo facility. During storm events, lead acid from the battery casings migrated into the soil below the battery casings, contaminating the soils at the property.

Risk Assessment

Human Health Risk Assessment

Contaminants in soil, groundwater, surface water, sediment, and fish tissue were evaluated for potential human health threats under current and future land-use scenarios.

There is potential for unacceptable health risks to current and future residents at the Matteo property and anglers consuming fish caught in Hessian Run and Woodbury Creek. Additionally, the presence of elevated lead concentrations in soil, groundwater, surface water, and fish may cause adverse health effects to site workers, trespassers, recreational users, residents, and anglers. Risks are overestimated for current residents at the Matteo property from potential use of groundwater for drinking water. Based on the RI data, all risk drivers identified in groundwater were either not detected in the potable wells or were present at levels below federal Maximum Contaminant Levels and state groundwater standards in potable wells at the rental house. Thus, current exposure to groundwater is not a concern for residents at the rental house. Lead in soil, groundwater, surface water, and fish; antimony in groundwater; and PCBs in fish and soil were identified as risk drivers related to the Matteo site. Risks attributable to arsenic, iron, vanadium, cPAHs, and vinyl chloride are most likely due to sources unrelated to the Matteo site.

Screening Level Ecological Risk Assessment

As part of the RI/FS, CDM Smith conducted a screening level ecological risk assessment (SLERA) to evaluate the potential for ecological risks at the Matteo site. No federally listed or proposed threatened or endangered species are known to exist within the vicinity of the site. The NJDEP Natural Heritage Program reported the occurrence of the great blue heron (*Ardea herodias*), a species of special concern, near the site. No other species or communities of concern were noted on or within 1/4 mile of the site.

A prior ecological investigation was conducted on behalf of NJDEP and focused primarily on aquatic portions of the site but also included select upland areas. This ecological risk assessment (ERA) identified a link between site contaminants and adverse effects to terrestrial and aquatic receptors/communities and noted that wildlife utilizing areas of highest site-related contamination for foraging were at risk.

The CDM Smith SLERA evaluated exposure of ecological receptors to chemicals in site media through direct contact and dietary habits. Media evaluated included soil, sediment, surface water, porewater, and seep water.

Dietary exposure risks were identified using food chain models for bioaccumulative chemicals detected in sediment and soil. The hazard quotient (HQ) method was employed, comparing total dose to toxicity reference values (TRVs) for each species evaluated. Ten species representing the avian and mammalian communities inhabiting the site were evaluated using food chain exposure modeling.

The SLERA determined that there are contaminants in all site media at levels that may cause adverse effects to ecological receptors via both direct exposure and dietary exposure. Multiple chemicals were determined to be risk drivers, but lead was the most prominent, affecting all site media and causing risk via both direct and dietary exposure.

Step 3a Ecological Risk Assessment

The Step 3a ERA was conducted to refine the list of chemicals of potential concern that were identified in the SLERA. Results of the Step 3a evaluation indicated fewer risks from exposure to chemicals detected in site media when compared to the SLERA. Metals continue to be the primary risk driver in all site media based on direct exposure. Dioxins/Furans, pesticides, and PCBs also pose a risk; however, exceedances of ecological screening levels for PCB Aroclors in soil and sediment were minimal. Due to the limited number of samples and detected concentrations, 95% upper confidence levels could not be calculated for dioxins and PCBs in sediment and pesticides in soil, and maximum concentrations were used. The use of maximum values as exposure point concentrations most likely overestimates risks.

Chemicals present in sediment pose little risk to ecological receptors based on food chain exposure models. The only exception was exposure to lead for piscivorous birds based on the great blue heron model where an HQ of 1.2 was calculated. Since the daily dose of lead calculated is so close to the TRV to which it is compared, and with the conservative assumptions used such as a site foraging factor of 1.0, and assuming the great blue heron's diet consists only of fish, risk from exposure to lead in sediment is most likely overestimated.

Chemicals identified as risk drivers in soil based on food chain exposure models consist primarily of the site-related metals lead and zinc. Pesticides, PCB Aroclors, and dioxins were also noted as risk drivers based on the American robin and short-tailed shrew models used to represent insectivorous birds and mammals. Except for gamma-chlordane and endrin, model results for these pesticides produced relatively low HQs (not exceeding 7), suggesting minimal risk.

Remedial Action Objectives

Remedial action objectives (RAOs) were developed for source materials, soil, and groundwater. The remediation of source materials and contaminated soil is expected to decrease site-related contaminant concentrations in groundwater to meet the preliminary remediation goals (PRGs). Contaminated sediment and surface water will be addressed under OU3.

Source material RAOs:

- Eliminate migration of contamination from the source materials to sediment, surface water, soil, and groundwater.
- Eliminate exposure to source materials by human and ecological receptors.

Contaminated soil RAOs:

- Reduce or eliminate exposure to contaminated soil at concentrations exceeding the PRGs by human and ecological receptors through ingestion, inhalation, and dermal contact.
- Minimize contaminant migration to sediment, groundwater, and surface water.

Contained groundwater RAOs:

- Reduce site-related contaminant concentrations by remediating source materials and contaminated soil exceeding the PRGs.

Groundwater quality will be monitored under OU1 to collect data that can be evaluated to support a future groundwater decision document.

Preliminary Remediation Goals

To meet the RAOs, PRGs were developed to aid in defining the extent of contaminated media requiring remedial action and developing cost estimates in the FS.

Preliminary Remediation Goals for Source Materials

For this site, the battery casings exhibit elevated concentrations of lead and are characteristically hazardous (D-008 for lead). Collectively, battery casings mixed with municipal waste, soil, and sediment are considered source materials because these materials serve as a continued source of contamination to soil, sediment, and potentially groundwater through wind entrainment, stormwater runoff, inundating tidal water, and infiltration from precipitation. Therefore, these source materials are considered principal threat waste and will be remediated (stabilized and contained on-site or removed from the site).

Preliminary Remediation Goals for Soil

Regulatory requirements, human health and ecological risk-based values, and background values were considered in the development of the PRGs for soil. Both federal and state chemical-specific applicable or relevant and appropriate requirements (ARARs) were identified. Toxic Substances Control Act (TSCA) and NJDEP NRDCSRS are considered applicable requirements for the scrapyard area of the Matteo property and the Mira Trucking property, which are zoned as commercial (non-residential). The open field/ waste disposal area is zoned vacant/residential; however, its location within the 100-year floodplain and adjacent to a commercial scrapyard inhibits any residential construction in the foreseeable future. Therefore, the NJDEP NRDCSRS are considered applicable requirements for the open field/waste disposal area.

In addition, ecological risk-based PRGs for lead and zinc were calculated for surface soil of the open field/waste disposal area. However, because the ecological risk-based PRGs are below the background values, the site-specific background values for lead and zinc were used as the PRGs for surface soil (0 to 1 foot bgs) in the open field/waste disposal area.

Furthermore, NJDEP RDCSRS are considered applicable requirements for the Willow Woods property, the rental home area, and the residential property adjacent to Mira Trucking (P002), which are zoned residential. The new EPA Region 2 policy for residential lead cleanup based on EPA's 2016 memorandum on how to develop a residential lead cleanup standard is also considered.

Preliminary Remediation Goals for Groundwater

NJDEP Groundwater Quality Standards (GWQS) are chemical-specific ARARs. Groundwater at the site is classified as Class IIA, suitable for drinking water use, even though it is not currently utilized as a source of potable water. Federal and NJDEP drinking water standards are also relevant and appropriate requirements. For all site-related contaminants, NJDEP GWQS are the most stringent promulgated standards and were used to develop the PRGs. Because NJDEP GWQS were developed with consideration for human health risks, site-specific risk-based criteria were not developed.

Identification of Media and Areas that Require Remediation

Five media are identified as contaminated: source materials, soil, sediment, groundwater, and surface water. Source materials refer to battery casings, municipal waste mixed with battery casings, and sediment and soil mixed with battery casings. Source materials and soil contamination above the PRGs would be remediated in OU1. Contaminated sediment and surface water would be addressed under OU3. Groundwater quality will be monitored under OU1 to collect data that can be evaluated to support a future groundwater decision document. The long-term groundwater monitoring will not be the final action for groundwater.

Remedial Action Alternatives

Remediation technologies and process options were screened against site-specific conditions using three criteria: effectiveness, implementability, and relative cost.

Representative process options were selected from the retained remedial technologies to develop remedial alternatives. Other process options may still be applicable and should be considered during remedial design. Five remedial alternatives were developed as follows:

Alternative 1 – No Action

Alternative 2 – Excavation, Stabilization, On-site Containment, and Capping

Alternative 3 – Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping

Alternative 4 – Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping

Alternative 5 – Excavation and Off-site Disposal

Alternatives 2 through 5 would include the following common elements:

- Pre-design investigation
- Remedial design
- Excavation and on-site handling of source materials
- Temporary restoration of the shoreline of Hessian Run
- Institutional controls: groundwater classification exception area
- Excavation and off-site disposal of source materials and contaminated soil from the Mira Trucking property and adjacent residential property P002

- Connection to city water for Matteo's scrapyard operation facility, the rental home property, and the former Billy-O-Tire property
- Long-term monitoring of groundwater
- Site reviews

Alternative 1 – No Action

No remedial action would be implemented under this alternative. The No Action alternative was retained in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan to serve as a baseline for comparison with the other alternatives.

Alternative 2 – Excavation, Stabilization, On-site Containment, and Capping

Under Alternative 2, source materials would be excavated, dewatered as necessary, then placed in an on-site engineered containment cell above the 100-year flood zone. To remove the source materials along the bank of Hessian Run, a temporary berm or dam or sheet pile would be installed to block tidal water from entering the excavation area. Dewatering of the excavation area would be conducted as necessary when excavation is performed below the water table. Contaminated soils exceeding the NRDCSRS for lead in the open field/waste disposal area and contaminated soil from the rental home property would be excavated, stabilized as necessary, and consolidated on top of the PCB-contaminated area in the open field/waste disposal area. The remaining contaminated area exceeding the PRGs in the open field/waste disposal area would be covered using imported clean fill and top soil with soil erosion control measures.

Contaminated soil at the scrapyard area is currently partially capped under an asphalt pavement. During the remedial action, all contaminated areas would be covered with asphalt. A stormwater management system would also be designed and installed to minimize the impact of stormwater runoff from the asphalt to the surround areas.

The shoreline along Hessian Run would be temporarily restored for slope stability and erosion controls. A minimum of 1 foot of clean fill would be applied to cover the excavated area after source materials are removed. Post-excavation sampling would be performed to document the level of contamination left in place after source material removal. After restoration, this area would be inundated with tidal water and is subject to additional evaluation in OU3.

A monitoring program would be developed and implemented to monitor the water quality of groundwater and collect data to support a future groundwater decision document. Institutional controls would be implemented. Routine inspection and maintenance of the engineered containment cell and caps would be implemented.

Alternative 3 – Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping

Alternative 3 is like Alternative 2, except that the source materials would be disposed off-site as hazardous waste in a Subtitle C landfill as opposed to being contained on-site in an engineered containment cell. Therefore, institutional controls and inspection and maintenance for the on-site containment cell would not be necessary in Alternative 3 as compared to Alternative 2. The remaining components would be identical to Alternative 2.

Alternative 4 – Excavation and Off-site Disposal of Source Materials and Contaminated Soils, and Capping

Under Alternative 4, source materials and contaminated soils in areas other than the scrapyard area would be excavated and disposed off-site. Compared to Alternative 3, a large volume of PCB- and lead-contaminated soils in the open field/waste disposal area previously covered in place would be excavated for off-site disposal under Alternative 4. Methods of excavation of source materials and contaminated soils would be performed in the same manner as described in Alternative 3. Contaminated soil at the scrapyard area would be capped with asphalt as described under Alternative 2. The remaining components would be the same as Alternative 3, except inspection and maintenance would not be required in the open field/waste disposal area.

Alternative 5 – Excavation and Off-site Disposal

Under Alternative 5, source materials and all contaminated soils would be excavated and shipped off-site for disposal at a Subtitle D landfill if non-hazardous, a Subtitle C landfill if hazardous, or a TSCA disposal facility for PCB TSCA waste. Institutional controls, such as deed notice, would not be required. Other components would be the same as for Alternative 4.

Comparative Analysis of Remedial Action Alternatives

Overall Protection of Human Health and the Environment

Alternative 1 would not provide protection of human health and the environment because no action would be taken to eliminate the exposure pathways to human and ecological receptors and no action would be taken to remediate site contamination. Alternatives 2, 3, 4, and 5 would achieve the RAOs and would provide protection to human health and the environment. The exposure pathways to human and ecological receptors would be eliminated or significantly reduced. Under Alternative 2, the source materials would be contained in an on-site engineered containment cell. Under Alternatives 3, 4, and 5, the source materials would be removed from the site and disposed off-site. Under Alternatives 2 and 3, excavated contaminated soil with elevated lead concentration would be stabilized prior to being consolidated under a cap. Under Alternatives 4 and 5, all excavated soils would be disposed off-site. Under Alternatives 2, 3, and 4, the caps need to be inspected and maintained, and institutional controls need to be implemented for continuous protection of human health and the environment. Alternative 5 provides the highest degree of protection to human health and the environment because all contamination would be removed from the site.

Under Alternatives 2 through 5, the shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.

Compliance with ARARs

TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs for contaminated soils. EPA's memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" is a 'To Be Considered" document. Alternative 1 would not meet the chemical-specific ARARs or the PRGs because no action would be taken. Alternatives 2 through 5 would comply with the chemical-specific ARARs and would meet the PRGs because the source materials and contaminated soil would be treated and contained or removed from the site. Groundwater would be monitored to collect data to support a future groundwater decision document. Location- and action-specific ARARs would be met by following the health and safety requirements and complying with all necessary regulations and permits. Corrective Action Management Units would be used for Alternatives 2 and 3 for on-site containment of hazardous materials in an engineered cell and on-site treatment of hazardous soil and consolidation of treated soil under a cap.

Long-Term Effectiveness and Permanence

Alternative 1 would not provide any long-term effectiveness and permanence because no action would be taken to remove the contamination or eliminate the exposure pathways to human and ecological receptors. Alternative 5 provides the highest long-term effectiveness and permanence. Alternatives 2 through 4 would provide long-term effectiveness and permanence to varying degrees as discussed below.

Magnitude of Residual Risk: Alternative 5 would not have any residual risks because all source materials and contaminated soils would be removed from the site. The magnitude of residual risks of Alternatives 2 through 4 depends on the reliability of the engineered cell and/or the caps in preventing exposure of human and ecological receptors to the contaminants. Based on the amount of contaminated materials remaining on-site, Alternative 4 has less potential residual risk than Alternative 3 followed by Alternative 2 because all excavated source materials and contaminated soils would be removed from the site in Alternative 4. Only source materials would be removed from the site in Alternative 3, and the source materials and contaminated soils would be contained on-site in Alternative 2.

Adequacy and Reliability of Controls: The adequacy and reliability of the engineered cell and soil caps under Alternatives 2 through 4 rely on routine inspection and maintenance of the engineered cell and the caps and the effective enforcement of the institutional controls. Without adequate inspection and maintenance, erosion or damage of the caps may expose the source materials and contaminated soils to receptors. The requirement for maintaining the integrity of caps for Alternative 2 is the highest since Alternative 2 consists of an engineered cell and large capped areas in both the open field/waste disposal area and the scrapyard area, followed by Alternative 3 (capped areas both in the open field/waste disposal area and in the scrapyard area), then Alternative 4 (only the capped areas in the scrapyard area). Since a large capped area in open field/waste disposal area under Alternatives 2 and 3 is below the 100-year flood zone, the requirements for inspection and maintenance of this cap would be much higher than for Alternative 4. For Alternative 5, control measures for residual contamination would not be necessary since all contamination would be removed from the site.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 would not have any reduction of toxicity, mobility, or volume (T/M/V) through treatment since no action would be taken. Alternatives 2 through 5 would reduce the mobility of the contaminants through treatment to different degrees. Alternative 2 would reduce the mobility of contaminants through on-site stabilization of excavated soils; Alternative 3 would reduce the mobility of the source materials through treatment to meet the universal treatment standards prior to landfill disposal and reduce the mobility of contaminants in excavated soils through on-site stabilization; Alternatives 4 and 5 would reduce mobility of source materials and excavated hazardous soils through off-site treatment to meet the universal treatment standards prior to landfill disposal. There are no reduction of volume and toxicity of contamination through treatment under Alternatives 2 to 5.

Short-Term Effectiveness

Alternative 1 would not have any short-term impact since no action would be taken. Alternative 5 would have the highest short-term impact to the local community because of its highest requirements for transportation of contaminated materials for off-site disposal and importing of materials for site restoration. Alternative 5 would also most likely require temporary shutdown of the existing operation at the scrapyard area. The short-term impact to the local community for Alternative 2 and Alternative 4 may be similar because Alternative 2 would require the construction of an on-site containment cell while Alternative 4 would require a larger quantity of contaminated soil to be excavated and transported compared to Alternative 2. Alternative 3 would cause the least short-term impact to local community compared to Alternatives 2,4, and 5 because the volume of contaminated materials to be excavated and handled under this alternative is less than Alternatives 4 and 5 and it does not require the construction of an on-site containment cell as under Alternative 2. Construction would generate noise and dust during the day, which would be controlled to minimize impact to the Willow Woods community. Construction or improvement of a cap at the scrapyard area under Alternatives 2 through 4 would require coordination with the existing operation.

The construction duration for Alternative 3 would be the shortest, approximately 2.5 to 3 years. The construction duration for Alternatives 2, 4, and 5 were estimated to be approximately 3 to 3.5 years. The on-site containment of hazardous waste in an engineered containment cell under Alternative 2 would raise the elevation by approximately 6 feet and may be viewed as unpleasant to the local community. A monitoring program would be developed to ensure the integrity of the containment cell as designed. The consolidation and capping of contaminated soil in the open field/waste disposal area under Alternatives 2 and 3 would be approximately 2 feet higher than existing grade. The drainage pattern would be designed to ensure that stormwater runoff would be directed to Hessian Run and would not impact the scrapyard area or the Willow Woods property.

Implementability

Alternative 1 is easiest to implement since no action would be taken. Alternatives 2 through 5 are implementable. Equipment and experienced vendors for excavation, backfill, on-site stabilization of lead-contaminated soils, construction of an engineered containment cell, and shoreline restoration are commercially available. Even though building an earthen berm is assumed in this FS for cost estimating purposes for excavation along Hessian Run, other methods that would keep the excavated area from impact by inundating tide would also be evaluated and potentially may be more cost-effective than an earthen berm. Measures for soil erosion controls and wetland restoration along Hessian Run are also proven technologies.

Alternative 2 has the highest complexity in design, implementation, and long-term monitoring since it involves the design and construction of a Subtitle C landfill.

For Alternatives 2 through 4, a long-term monitoring and maintenance plan would need to be developed for the on-site containment cell, the cap in the open field/waste disposal area, and the cap in the scrapyard area. Funding would need to be set aside for this activity to ensure continued protection of human health and the environment. Alternative 4 has less long-term monitoring and maintenance than Alternatives 2 and 3 since the only capped area is at the scrapyard area. There are no inspection and maintenance requirements under Alternative 5.

Alternatives 2 through 5 would require varying levels of institutional controls. For Alternative 4, a deed notice is already in place to prevent any activities that may compromise the effectiveness of the selected remedy. For all alternatives, a groundwater CEA would be established until the groundwater PRGs are met.

Cost

Alternative 1 has the lowest present worth since no action would be taken. Alternative 5 has the highest present worth costs due to high costs for off-site disposal of the largest volume of contaminated soils and waste but negligible operation and maintenance (O&M) costs. Alternative 4 has the second highest present worth, followed by Alternative 3, then Alternative 2.

Cost Item	Alternative 1 – No Action	Alternative 2 – Excavation, Stabilization, On-site Containment, and Capping	Alternative 3 – Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping	Alternative 4 – Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping	Alternative 5 – Excavation and Off-site Disposal
Capital Costs	$0	$33,339,000	$65,835,000	$71,460,000	$82,032,000
Annual O&M Cost	$0	$435,000	$124,000	$85,000	$50,000
Present Worth of O&M	$0	$5,124,000	$1,263,000	$785,000	$351,000
TOTAL PRESENT WORTH	$0	$38,463,000	$67,098,000	$72,245,000	$82,383,000

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Section 1

Introduction

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 032-RICO-02KD under the United States Environmental Protection Agency (EPA), Remedial Action Contract 2 to complete a remedial investigation (RI)/feasibility study (FS) for Operable Unit 1 of the Matteo & Sons, Inc. Superfund Site (the site) located in Thorofare, West Deptford Township, Gloucester County, New Jersey. The lead agency for the site is EPA Region 2. OU1 of the site is referred to as "the study area" for the remainder of the document.

The site has been divided into three operable units (OUs). OU1 addresses the source materials and soil contamination at the Matteo & Sons, Inc. property, the Mira Trucking property, and the Willow Woods community neighboring the site. OU2 focuses on the residential properties located at the Tempo Development. OU3 addresses the contaminated sediment and surface water. The RI by EPA started in 2011 and was performed prior to the division of operable units. It consists of data for what became OU1 and OU3. These data are discussed below and used to develop the conceptual site model (CSM) (see Section 1.7).

CDM Smith has completed the final RI report (CDM Smith 2018a) to document the current site conditions and address data gaps identified from review of previous investigations. CDM Smith has also completed an RI addendum documenting additional investigations that have taken place in the study area since the submittal of the final RI report(CDM Smith 2019). These additional investigations include the sampling performed by Weston Solutions, Inc. (Weston) on behalf of the EPA Environmental Response Team at the Mira Trucking property and adjacent residential properties from November 2017 to December 2018 and the sampling of the potable well on the rental home property in November 2018. Data collected by CDM Smith and during previous investigations have characterized the site sufficiently to define the nature and extent of the source material and the site-related contaminants in soil, sediment, surface water, groundwater, seeps, and sediment porewater. CDM Smith has also completed the *Final Human Health Risk Assessment* (HHRA) (CDM Smith 2016), and the *Final Screening Level Ecological Risk Assessment* (CDM Smith 2018b), and the *Final Step3A Ecological Risk Assessment* (CDM Smith 2018c).

This FS was prepared in accordance with the *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988). It presents the rationale for screening and evaluating a range of remedial technologies and developing remedial alternatives to remediate the source material, sediment, and soil contamination at the site.

1.1 Purpose and Organization of Report

The purpose of the FS is to identify, develop, screen, and evaluate a range of remedial alternatives for the contaminated media and to provide the regulatory agencies with sufficient information to select a feasible and cost-effective remedial alternative that protects public health and the environment from potential risks at the site. This FS report is comprised of four sections as described below.

- **Section 1 – Introduction** provides a summary of the EPA RI, including study area description, study area history, study area physical characteristics, RI sampling results, nature and extent of contamination, CSM, and human health and ecological risks.

- **Section 2 – Development of Remedial Action Objectives and Screening of Technologies** presents a list of remedial action objectives (RAOs) developed by considering the characterization of contaminants, the risk assessments, and compliance with site-specific applicable or relevant and appropriate requirements (ARARs); documents the quantities of contaminated media; identifies general response actions (GRAs); and identifies and screens remedial technologies and process options.

- **Section 3 – Development and Screening of Remedial Action Alternatives** presents the remedial alternatives developed by combining the feasible technologies and process options and provides the conceptual design assumptions and descriptions of each alternative.

- **Section 4 – Detailed Analysis of Remedial Action Alternatives** provides a detailed analysis of each alternative with respect to the following seven criteria: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume (T/M/V) through treatment; short-term effectiveness; implementability; and costs. Two additional criteria—state acceptance and community acceptance—are not evaluated in this FS. This section also provides an overall comparative analysis of the remedial alternatives.

- **Section 5 – References** provides a list of references used in the study.

1.2 Site Location and Description

The Matteo Study Area is located at 1708 U.S. Highway 130 (1692 Crown Point Road) in Thorofare, West Deptford Township, Gloucester County, New Jersey (Figure 1-1). The study area consists of the Matteo property, nearby properties (Willow Woods, the former Billy-O-Tire, and Mira Trucking), and portions of Hessian Run and Woodbury Creek. The Matteo property occupies two tax parcels (Lot 2, Block 128 and Lot 2, Block 325) as identified on the West Deptford Township Tax Map. The study area has been divided into several areas based on physical features, historical information, and the locations of samples collected during the RI and previous investigations. These areas are shown in Figure 1-2 and are described below.

- Matteo property – The Matteo property, which was once a farm, consists of 82.5 acres and includes the contiguous upland areas and adjacent mudflats located between the confluence of Woodbury Creek, Hessian Run, and U.S. Highway 130 (Crown Point Road). The Matteo property includes the scrapyard area, the open field/waste disposal area, and the rental home area. Additionally, two utility lines (Colonial Oil and Public Service Electric & Gas [PSE&G]) are located on the northwestern portion of the property. The locations of the utility lines are shown in Figure 1-2.

    - Scrapyard area – The scrapyard area (approximately 10 acres) is the southeastern portion of the Matteo property that supports the active scrap metal recycling business. The scrapyard area is largely paved or covered with crushed stone.

  - Rental home area – This 2.3-acre property with a rental home owned by the Matteo family is separated from the remainder of the Matteo scrapyard area by a chain-link fence and gate.

  - Open field/waste disposal area – A large portion of the Matteo property (approximately 53 acres) is comprised primarily of heavily vegetated, undeveloped land. Within this area are several distinct waste disposal areas, delineated during previous New Jersey Department of Environmental Protection (NJDEP) RIs. Waste in this area includes crushed battery casings and an assortment of miscellaneous materials referred to in the NDJEP RI as general waste. General waste includes fabric, metal, glass, hose, tires, wood, household garbage, brick, plastic, powder, drums, concrete, Styrofoam, shingles, cement, wire, steel, chain-link fence, aerosol cans, and cardboard, among other items.

  - The Matteo property also includes approximately 17.2 acres of mudflats within Hessian Run that are below water at high tide.

- Willow Woods property – Willow Woods is a manufactured home community (approximately 14.5 acres) adjacent to the southwestern border of the Matteo property. The Willow Woods property is bounded by the Matteo property, U.S. Highway 130, and Woodbury Creek.

- Mira Trucking property – Mira Trucking leases the property to stage large trucks on the western and southern portions of the property. A vacant residence/office and a retention basin are located on the northeastern portion of the property. The property is approximately 178,000 square feet and was investigated in two phases conducted in November 2017 and December 2018, respectively. Several adjacent residences were also investigated in April 2018.

- Woodbury Creek – Woodbury Creek is a primary tributary of the Delaware River, located south of the Matteo property. The creek has narrow, deep channels (up to 12 feet below sea level) and extensive tidal flats along its northern and southern shores.

- Hessian Run – Hessian Run is a tributary of Woodbury Creek and eventually the Delaware River. This water body is adjacent to the northern property boundary of the Matteo property, with its farthest upstream reaches just east of U.S. Highway 130. Hessian Run is made up primarily of extensive tidal flats (mudflats), with small, shallow channels (less than 2 to 3 feet below sea level) extending through the flats.

- Former Billy-O-Tire property – A former truck and auto repair shop (approximately 1 acre) located between the Matteo property and the Willow Woods property.

1.3 Site History

The history of the site is summarized primarily from the 1996 preliminary assessment (NJDEP 1996), the *Supplemental Remedial Investigation Report* (The Louis Berger Group, Inc. [Louis Berger] 2002), and the NJDEP final RI report (Louis Berger 2004). Supplemental information has been gathered during discussions with EPA.

1.3.1 Ownership and Operations

According to public records, between 1907 and 1947, the site was owned by Samuel and Bertha Wilkins who used a portion of the property for farming activities while the remainder of the site was covered by woodlands. The Matteo family acquired the property in 1947. According to available records, the Matteo family, under various names (James Matteo & Sons, Inc.; Matteo Trucking Company; Thorofare Trucking and Trash Company; and Matteo Iron and Metal), has operated an unregistered landfill and junkyard and a metals recycling facility at the site since 1961. In 1968, NJDEP identified an inactive incinerator at the site. In April 1971, NJDEP approved James Matteo & Sons, Inc.'s request to operate the incinerator to burn copper wire. In May of that year, the company submitted a plan to operate a "sweating fire box" to melt lead battery terminals for lead reclamation. This lead melting operation continued until 1985. In 1972, NJDEP observed landfilling of crushed battery casings and household waste in an area of wetlands adjacent to Hessian Run. This operation was apparently performed in conjunction with the lead melting operation as there were several reports of battery casing incineration and subsequent on-site ash disposal. In addition to the incineration and landfilling operations, drums of waste were scattered throughout the property.

During the 2016 OU2 investigation of the 36 single-family residential properties located in and adjacent to the Tempo Development on Woodline Drive, Birchly Court, Oakmont Court, Hessian Avenue, and Crown Point Road, a resident informed EPA that dumping may have occurred at the Mira Trucking property as part of Matteo operations. This initiated investigation at the Mira Trucking property.

1.3.2 Regulatory History

Key elements of the site regulatory history are summarized below.

- In January 1984, NJDEP issued an Administrative Order on Consent to Matteo Iron and Metal for solid waste violations and required Matteo to cease waste disposal at the site.
- In June 2005, NJDEP submitted the site for consideration as a removal action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- In May 2006, EPA issued an Administrative Order on Consent to Matteo Iron and Metal to install a chain-link fence to restrict access to contaminated areas. To facilitate the fence installation, approximately 425 tons of lead-contaminated soil was excavated from the site and the Willow Woods property for off-site disposal.
- On September 27, 2006, the site was listed on the EPA National Priorities List.
- An Administrative Order on Consent between EPA and Matteo Iron and Metal was finalized on January 28, 2011.
- Crushed battery casing waste was discovered in November 2015 during a sewer lateral repair at a residential property located on Birchly Court in the Tempo Development neighborhood of West Deptford, Gloucester County, New Jersey. This area became OU2 of the Matteo site, referred to as the Birchly Court Site. The Birchly Court Site is located within 1 mile of OU1.

- Based on a meeting held with EPA and CDM Smith on September 1, 2016, EPA determined that sediments would be removed from OU1 and would be addressed under a separate operable unit—OU3.
- As part of the OU2 investigation, information was obtained that suggested dumping had occurred at the Mira Trucking across from the Matteo property. Sampling was conducted at the Mira Trucking property in two phases completed in November 2017 and December 2018, respectively. In April 2018, sampling was conducted at five adjacent residential properties, including the residence immediately west of the property, P002. . Due to the presence of battery casings and elevated lead concentrations, EPA added the Mira Trucking property and residential property P002 to OU1.

1.3.3 Current Conditions

Currently, the southern portion of the site along U.S. Highway 130 is an active metal salvaging facility that accepts scrap metal from individual, commercial, and industrial customers. Four inches of recycled crushed aggregate and/or recycled asphalt cover the unpaved portion of the scrapyard area to minimize exposure to contaminated soil. The remainder of the site is unused and vacant, relatively flat, sandy, and well drained with no evidence of ponding. Trails and dirt roads are present throughout the site, with prominent overgrown vegetation. A chain-link fence extends across the southern property boundary between the Willow Woods property and the Matteo property and the northeastern property boundary on Crown Point Road. On the northeastern portion of the property, but outside of the chain-link fence, there is a rental home with tenants, including children.

1.4 Summary of Previous Investigations for the OU1 Study Area

A detailed summary of the data and reports completed prior to the EPA RI is provided in the final RI report (CDM Smith 2018a). Reports produced for EPA and NJDEP were reviewed. The reports consisted of site investigations, ecological risk assessments, a geophysical survey, a remedial action work plan and report, and hazard ranking system documentation record.

Previous investigations at the site and their results are briefly summarized below.

- From 1968 through 1984, NJDEP conducted inspections and documented the following: a lead sweating operation, landfilling of crushed automobile battery casings along the banks of Hessian Run, unauthorized use of an incinerator for lead smelting operations, ash from lead smelting operations hauled to an on-site landfill, two fires at the landfill, abandoned drums of unknown waste, and a yellow waste dispersed across the site.
- In 1984, 1991, and 1992, Matteo conducted several limited sampling events.
- In 1996, NJDEP performed a preliminary assessment/site investigation.
- In June and July 1997, EPA conducted an extent of contamination investigation in the battery disposal area near monitoring well MW-05 and collected several surface soil samples.

- From 2000 to 2002, Louis Berger, a contractor for NJDEP, performed an RI and supplemental remedial investigation (SRI) on behalf of NJDEP to delineate the horizontal and vertical extent of soil contamination and characterize soil for potential off-site disposal.
- In 2003, NJDEP conducted an aquatic biota study to assess potential biological impacts of lead and polychlorinated biphenyl (PCB) contamination in sediment, surface water, and soils to justify a removal action. NJDEP also performed an ecological risk assessment (ERA).
- In 2005, NJDEP prepared a remedial action selection evaluation (RASE) based on the data collected during their RI and SRI.
- In April 2005, EPA collected soil samples to confirm the presence of lead and PCBs in soil within the Matteo property and the Willow Woods community.
- In February 2006, EPA conducted additional soil sampling to delineate lead contamination in Willow Woods and a residence east of the Matteo property.

1.5 Physical Characteristics of the Study Area

1.5.1 Topography and Drainage

The site is located within New Jersey's Coastal Plain Physiographic Province, with an average elevation of approximately 10 feet above mean sea level (msl). Of the Matteo property, approximately 32 acres of the site is within the 100-year floodplain, and 24 acres is above the floodplain. The majority of the site is unpaved and heavily wooded, with an overall slope toward the west/northwest and radially in the directions of Woodbury Creek and Hessian Run. The scrapyard area is the topographic high point, with an elevation of approximately 25 feet above msl. The site is situated at the confluence of Woodbury Creek and Hessian Run, which are part of the Delaware River basin. Runoff from the scrapyard area and the open field/waste disposal area flows north/northeast, through and over areas where waste and battery casings were landfilled, into Hessian Run. Seeps are present at low tide along Hessian Run, indicating that shallow groundwater discharges to Hessian Run. Runoff from the area west of monitoring well MW-09 primarily flows west into Woodbury Creek. Details of site topography and drainage are shown in Figure 1-3.

Bathymetric surveys were performed on Woodbury Creek and Hessian Run; the results are summarized below.

- Woodbury Creek has deep narrow channels (up to 12 feet below sea level) and extensive tidal flats along the northern and southern shores.
- Hessian Run is made up primarily of extensive tidal mudflats with small shallow channels (less than 2 to 3 feet below sea level).

1.5.2 Geology and Hydrogeology

1.5.2.1 Regional Geology and Hydrogeology

Regional Geology

The coastal plain of New Jersey is characterized by a wedge-shaped mass of unconsolidated sediments comprised of clay, silt, sand, and gravel, which thins to the north and has a thickness of over 6,000 feet at the tip of Cape May. These sediments range in age from Cretaceous to Holocene and can be classified as continental, coastal, or marine deposits. The Cretaceous and Tertiary sediments of the region; the Merchantville, Magothy, and Raritan Formations; and the Potomac Group generally strike in a northeast-southwest direction and dip gently to the southeast from 10 to 60 feet per mile. In Gloucester County, the first bedrock encountered is the Wissahickon Formation, which consists largely of schist and gneiss.

Regional Hydrogeology

The Potomac-Raritan-Magothy (PRM) aquifer system, one of the major aquifers of the coastal plain, is the primary aquifer in Gloucester County. The PRM aquifer system is a wedge-shaped mass of Cretaceous-age sediments comprised of alternating layers of clay, silt, sand, and gravel. It is confined by underlying crystalline rocks and the overlying Merchantville-Woodbury confining unit. The Merchantville Formation and the Woodbury Clay form a major confining unit throughout most of the coastal plain of New Jersey. The PRM is pumped heavily in the area, and water levels have declined approximately 50 feet since the mid-1960s; groundwater levels declined as much as 12 feet in Gloucester County between 1983 and 1988. A resulting cone of depression has caused the reversal of natural regional groundwater flow. Regional groundwater no longer discharges into the Delaware River; the river currently recharges the aquifer system.

1.5.2.2 Study Area Geology and Hydrogeology

Study Area Geology

Three geologic units were encountered at the site, as described below. Surface geology is shown on RI Figure 3-10 in Appendix A, and subsurface geology is shown on RI Figure 3-5 in Appendix A. The cross sections are shown on RI Figures 3-6 to 3-9 in Appendix A.

Cape May Formation

The Cape May Formation consists of Quaternary-age (Pleistocene) deposits that are typically yellow or brown, medium- to coarse-grained quartzose sand with some gravel and trace yellow, brown, black, or gray clay. The formation is approximately 15 to 20 feet thick in the eastern portion of the site and approximately 40 feet thick in the western portion.

Merchantville Formation

The Merchantville Formation is encountered beneath the Cape May Formation in the eastern and southern portions of the site where it is approximately 20 feet thick. The formation thins and eventually pinches out in the western portion of the site as shown on RI Figures 3-7 and 3-8 in Appendix A. The unit is generally very dark gray clays and silts with some sand and is known to be rich in glauconite. The primary constituents of the glauconitic soils are aluminum, calcium, iron, magnesium, potassium, and sodium, but several studies have also shown it to be rich in trace elements such as antimony, arsenic, barium, beryllium, boron, cadmium, chromium, lead, manganese, and vanadium. These inorganic analytes were found at elevated levels in site soils.

Magothy Formation
The Magothy Formation underlies the Merchantville and Cape May Formations and extends at least to the maximum drilled depth (approximately 100 feet below ground surface [bgs]). It is generally light gray sand with clay and silt lenses. In the western portion of the site where the Merchantville Formation pinches out, the Cape May directly overlies the Magothy Formation.

Study Area Hydrogeology
Two flow systems are present at the site—a shallow perched flow system and a deep regional flow system—as described below.

Shallow (Perched) Groundwater
The perched groundwater system is observed in the Cape May Formation; depth to groundwater ranges from approximately 5 to 14 feet bgs. Changes in elevation in the shallow groundwater between low tide and high tide were minimal, generally, less than 0.1 foot, indicating no significant tidal influence and suggesting the aquifer is unconfined. The extent of this perched water zone mirrors the extent of the Merchantville Formation.

Generally, the perched groundwater flows radially away from the topographically elevated scrapyard area. In the extreme eastern portion of the site and along the northern shoreline, the perched groundwater flows north discharging to Hessian Run; the remainder flows toward the topographically lower western portion of the site where the Merchantville Formation is absent.

Deep (Regional) Groundwater
The PRM aquifer system is described as a single hydrologic unit. The average horizontal hydraulic conductivity in the PRM aquifer is 13.6 feet/day. In the western portion of the site where the Merchantville Formation is not present, the water levels in shallow wells are an expression of the regional potentiometric surface. In the eastern portion of the site, the regional potentiometric surface is separated from the shallow perched groundwater table by the Merchantville Formation, creating confined conditions in the deep aquifer in this area.

The regional deep groundwater flows to the southeast. The hydraulic gradient in the PRM is horizontally to the southeast and vertically downward from the shallow perched groundwater to the deep regional groundwater. Groundwater elevation data for the deep regional aquifer collected during low and high tide suggest that tidal changes do not markedly influence the gradient in the deep aquifer at the site.

1.5.3 Tidal Influence

1.5.3.1 Tides

National Oceanic and Atmospheric Administration tidal predictions for Woodbury Creek in 2011 and 2012 were used to examine daily and seasonal tidal variations in the area of the Matteo site. The tide data are shown in Figure 1-4. The mean low tide is approximately 0.3 foot above mean lower low water (MLLW), and the mean high tide is approximately 6.4 feet above MLLW, with a mean tide level of 3.2 feet above MLLW. The tides vary substantially throughout the year. Peak high tides occur in the spring, reaching 7.6 feet above MLLW. Tidal elevations then drop, bottoming out in late summer, and then climb to a second, less pronounced peak around October. Finally, the lowest low tides occur in the winter, between January and February, with low tides nearly 1 foot below MLLW. The greatest disparity between low tide and high tide tends to occur in the spring, between March and June. These tidal water levels and seasonal fluctuations should be considered in the design and implementation of the remedial action.

1.5.3.2 Groundwater/Surface Water Interaction

During the EPA RI, the effects of tidal fluctuations on groundwater were monitored using pressure transducers. The transducers were deployed for 2 months in two shallow monitoring wells (MW-01 and MW-05), two deep monitoring wells (MW-16D and MW-21D), and a still well in Hessian Run. Water level data were collected continuously and compared to the tidal fluctuations in Hessian Run. These data, along with data from synoptic groundwater level monitoring events, were used to further define the relationship between surface water and groundwater as described below.

- The surface water tidal fluctuations have minimal influence on the shallow perched groundwater levels. At both low and high tides, the perched groundwater levels were higher than the water levels in Hessian Run, indicating a hydraulic potential from the site toward Hessian Run. The shallow perched groundwater discharges laterally to Hessian Run or toward the western portion of the site into the regional aquifer where the Merchantville Clay is absent.

- Seeps are present along the shoreline at low tide in areas where the land surface slopes into both Hessian Run and Woodbury Creek.

- The deep regional groundwater levels below the confining layer (Merchantville Formation) showed a small response to surface water tidal changes on the order of 1 inch, suggesting these systems are hydraulically connected, likely in the area where the Merchantville Formation ends. This and the high vertical gradients across the Merchantville Formation (confining layer) suggest that the deep zone to the east is confined. Precipitation was observed to recharge the deep zone where it is connected to unconfined aquifers or where it outcrops.

- The surface water bodies are gaining streams in the areas where the Merchantville Formation is present and the perched groundwater elevations are above the creek elevations. To the west, the creeks feed the regional aquifer as groundwater elevations are below the surface water elevations. In the western portion of the site where the Merchantville Formation is absent, there is a transition zone where the shallow perched groundwater discharges to the regional aquifer.

1.5.4 Floodplain

The Federal Emergency Management Agency (FEMA) has identified geographic areas prone to flood risks, termed flood hazard zones. The flood hazard zones at the Matteo site were identified to be areas below 9 feet above msl using the FEMA Map Service Center. The FEMA map has yet to be revised since the flooding during Hurricane Sandy in 2012. Using the high flood-stage during the storm, a revised approximate 100-year flood zone is shown in Figure 1-2. The western portion of the site, more than half of the Matteo property, is within the Special Flood Hazard Area, subject to inundation by the 100-year flood (the flood that has a 1% chance of being equaled or exceeded in any given year).

1.5.5 Wetlands

Four types of wetland habitat were observed and delineated within the site during the NJDEP RI (Louis Berger 2004) as shown in Figure 1-5. The wetland areas include riverine tidal emergent wetlands (R1EM), palustrine emergent, persistent wetlands (PEM1), palustrine forested broad-leaved deciduous wetlands (PFO1), and riverine tidal open water (R1OW). A description of each wetland type is provided below.

Riverine Tidal Emergent Wetlands (R1EM)

The Woodbury Creek-Hessian Run marshes are freshwater tidal marshes that are relatively flat and regularly flooded by slightly brackish tides. They provide habitats for muskrat, ducks, and geese. These areas have been identified by the Atlantic Coast Ecological Inventory as a part of the Delaware River Estuary, which contains game fish such as the American shad and the striped bass. Dominant vegetation consists of non-persistent plants, including arrow arum, pickerelweed, and arrowhead. Portions of this area include mudflats and small channels that drain surface water at low tides. The substrate ranges from organic clays to silt loam.

Palustrine Emergent, Persistent Wetlands (PEM1)

A portion of the delineated wetlands consists of persistent emergent vegetation that occupies a transition area between the uplands and/or forested wetlands and the broad freshwater tidal marshes of Hessian Run and Woodbury Creek. Dominant vegetation consists of common reed, tussock sedge, and broad-leafed cattail. Red osier dogwood, Japanese honeysuckle, multiflora rose and northern arrowwood are present along the margins. The substrate in the wetland ranged from organic clays to silt loam, having low chromas, gleying, and mottling. The hydrology varied from saturated soils to flowing and ponded water. Other hydrologic indicators observed include drainage patterns, water marks on vegetation, and water-stained vegetation.

Palustrine Forested Wetland (PFO1)

The southwestern portion of the site contains a forested wetland that adjoins palustrine emergent wetlands outside the study area limits. Dominant vegetation consists of red maple, slippery elm, and nannyberry within the canopy and shrub layers. In addition, reed canary grass and tussock sedge occur in a narrow transition area between the emergent wetland and the forested wetland. The soils in the wetland ranged from clay loam to silt loams, having low chromas and mottling. The observed wetland hydrology varied from saturated soils to surface inundation of several inches. Other hydrologic indicators included drainage patterns, water marks on vegetation, and water-stained vegetation.

Riverine Tidal Open Water (R1OW)

Woodbury Creek and Hessian Run form the final wetland type of riverine open water. These wetlands occur on the edges of the site areas where the freshwater tidal emergent wetlands transition into the creeks. Narrow mudflats exposed at low tide are included in this area.

1.5.6 Municipal Waste Landfill Area

During the NJDEP RI, test pits were excavated to investigate the extents of battery casings and buried wastes. Waste found consists of fabric, metal, glass, hose, tires, wood, household garbage, brick, plastic, powder, drums, concrete, Styrofoam, shingles, cement, wire, steel, chain-link fence, aerosol cans, and cardboard, among other items. The drums were inspected and sampled when necessary; the results were found to be non-hazardous. During the EPA RI, groundwater screening samples were collected for volatile organic compounds (VOCs) and Target Analyte List (TAL) metals analysis. Groundwater samples were collected from monitoring wells for VOCs, semivolatile organic compounds (SVOCs), PCBs, pesticides, and TAL metals. These results did not indicate any adverse impacts from the general waste, consistent with the NJDEP findings. Based on the coastal management rule, the general waste is considered unauthorized fill prior to September 26, 1980. Since there is no indication that the general waste has resulted in any ongoing adverse environmental impact, the general waste is not considered to require remediation. There are approximately 28,500 cubic yards (CY) of general waste.

1.6 Nature and Extent of Contamination

The nature and extent of contamination in site media was assessed by comparing sample results to the screening criteria developed during the EPA RI (CDM Smith 2018a). Lead, antimony, copper, zinc, and PCBs were identified as site-related contaminants in the RI because these compounds are related to past site operations and exceed screening levels and local background levels. Data from the EPA RI and previous RIs were included in the evaluation.

1.6.1 Source Materials

Test pits were excavated during the NJDEP RI to determine the horizontal and vertical extent of buried wastes (Louis Berger 2004). Three types of waste materials were identified: battery casings, a mix of battery casings and municipal waste, and municipal waste. The extents of these three types of waste are shown in Appendix B. Among them, battery casings and municipal wastes mixed with battery casings are considered the source of lead contamination. In addition, the NJDEP RI data also indicated that the soil immediately below the battery casing is highly contaminated. This soil could also serve as a contamination source. Furthermore, based on observations during the EPA RI and evaluation of the RI data (sediment concentrations), battery casings mix with sediment along the shore of Hessian Run which resulted in high lead concentrations in sediment. This highly contaminated sediment could serve as a source of contamination for sediment in the mudflat.

Collectively, battery casings mixed with municipal waste, soil, and sediment are considered source materials because these materials serve as a continued source of contamination to soil, sediment, and potentially groundwater through wind entrainment, stormwater runoff, inundating tidal water, and infiltration from precipitation.

Based on available data, there are approximately 19,400 CY of battery casings and 19,100 CY of municipal waste mixed with battery casings exist at the site (Louis Berger 2004). Highly contaminated soil below the battery casing waste is approximately 9,100 CY, and approximately 8,600 CY of battery casings mixed with sediment exist along the shoreline of Hessian Run.

During the 2017 and 2018 EPA investigations, battery casings were also identified on the Mira Trucking property (CDM Smith 2019). A high density of battery casings was found in the southern portion of Truck Staging Area 1 and the southwestern portion of Truck Staging Area 2. The battery casing material was found to consistently contain high lead concentrations and was identified as the likely source of lead contamination in soil at the Mira Trucking property.

1.6.2 Summary of Soil Contamination

The extent of contamination and range of concentrations for lead, antimony, copper, zinc, and PCBs in soil are presented on RI Figures 4-1 through 4-6 in Appendix A, respectively. Approximately two-thirds of the Matteo property (eastern portion) above the mudflats is zoned as commercial while the rest (western portion) is zoned as residential/vacant; however, its location within the 100-year floodplain and adjacent to a commercial scrapyard inhibits any residential construction in the foreseeable future. Therefore, the open field/waste disposal area is considered commercial for the purposes of this data summary. The Willow Woods property and the rental home area are zoned as residential. Therefore, contaminant concentrations were compared to the NJDEP non-residential direct contact soil remediation standards (NRDCSRS), with the exception of contaminant concentrations on the Willow Woods property, rental home area, and residential property P002, which are compared to the NJDEP residential direct contract soil remediation standards (RDCSRS).

Site-Related Contaminants

Lead

- Most lead contamination exceeding the NRDCSRS of 800 milligrams per kilogram (mg/kg) is concentrated in the upper 4 feet of soils in and near the scrapyard area and directly associated with the waste disposal areas along the northern shoreline of the site. The highest lead concentrations in the upper 2 feet of soils were 10,100 mg/kg from SB-110 collected during the EPA RI and 31,300 mg/kg from TP-3A from the NJDEP RI. In the 2- to 4-foot bgs interval, lead concentrations exceeded the NRDCSRS at only a few locations within or near the scrapyard area (RI Figure 4-1 in Appendix A); the highest lead concentrations were 94,100 mg/kg in SB-110 collected during the EPA RI and 12,000 mg/kg in TP-1C during the NJDEP RI.

- Lead contamination was also found consistently in the 4- to 8-foot bgs interval in areas directly associated with battery casing disposal. NJDEP found lead as high as 11,500 mg/kg in test pit samples from the battery casing disposal areas. EPA RI sampling found lead above 800 mg/kg at these depths in one location SB-110 (2,340 mg/kg) near the battery casing disposal area.

- Lead contamination in the 8- to 12-foot bgs interval exceeded the NRDCSRS criterion of 800 mg/kg and the NJDEP impact to groundwater (IGW) criterion of 90 mg/kg during the NJDEP RI. However, none of the soil samples from the seven borings installed by CDM Smith in 2011 within the scrapyard area exceeded the IGW criterion (RI Figure 4-1 in Appendix A).

- Soil samples were collected directly below the waste materials whenever waste was encountered in the test pits. In total, 12 samples were collected from the waste itself, and 87 soil samples were collected below the waste. Sample results from the waste and soil below the waste indicated noncontiguous spots of primarily lead and antimony contamination. Lead was observed up to 31,300 mg/kg in the waste along Hessian Run and up to 11,500 mg/kg in the soil below the waste along Hessian Run.

- In the rental home area, lower lead concentrations (mostly below the RDCSRS) were found in surface soils (0 to 2 feet bgs). Only one sample exceeded the RDCSRS at 763 mg/kg; this sample was collected on the driveway used to access the scrapyard area (RI Figure 4-1 in Appendix A). The average lead concentration for samples collected on the remainder of the property was greater than 200 mg/kg.

- The Willow Woods property is a residential community. Lead was detected at low levels, below the NJDEP RDCSRS of 400 mg/kg, in the upper 4 feet of soil during EPA's RI. The maximum concentration detected was 75.5 mg/kg. Lead levels were higher prior to the removal action in Willow Woods and along the southern edge of the site. Samples collected during the NJDEP RI near the border between the Matteo property and the Willow Woods property contained lead as high as 14,500 mg/kg. During the previous removal action, an area beneath D-13 could not be accessed due to a cinder block foundation; the contaminated soil was capped in place with 4 inches of concrete and no longer poses an exposure risk.

- The Mira Trucking property is a 178,000-square-foot commercial property used to stage large trucks and previously was used for Matteo site operations. EPA conducted investigations in two phases at the property in November 2017 and December 2018. The results indicate that battery casings were present in the surface and subsurface soil at the Mira Trucking property and that concentrations of lead were above the NRDCSRS of 800 mg/kg in the upper 4 feet of soil. In general, elevated lead concentrations were colocated with the presence of battery casings. In addition, EPA conducted an investigation at several residential properties adjacent to the Mira Trucking property in April 2018. On the residential property (P002) immediately west of the Mira Trucking property, concentrations of lead were detected greater than the RDCSRS of 400 mg/kg.

Other Metals

- Elevated concentrations of antimony, copper, and zinc were generally colocated with the lead contamination in the upper 4 feet of soils in the scrapyard area while only antimony was elevated in the waste disposal areas. All three metals were found at concentrations less than the RDCSRS in the rental home area. This pattern suggests the lead, antimony, copper, and zinc were related to the metal reclamation processes in the scrapyard area while the lead and antimony were associated with the remaining battery casings/ash or other waste in those disposal areas.

- Antimony exceeded the NJDEP NRDCSRS of 450 mg/kg at one location during the EPA RI (SB-110 at 465 mg/kg from 2 to 4 feet bgs, shown on RI Figure 4-2 in Appendix A) and at one location during the NJDEP RI (GP-30 at 865 mg/kg from 0 to 0.5 foot bgs). Both locations also had lead exceedances, with the sample from SB-110 from 2 to 4 feet being the highest lead concentration observed throughout the site.

- Copper and zinc were detected at concentrations below the NJDEP NRDCSRS of 45,000 and 110,000 mg/kg in the open field/waste disposal and scrapyard areas and below the RDCSRS of 3,100 and 23,000 mg/kg in the rental home area as shown on RI Figures 4-3 and 4-4 in Appendix A, respectively.

- Arsenic, iron, manganese, cobalt, and vanadium exceeded the RI screening criteria throughout the entire site; however, these compounds are likely concentrated in soils due to the presence of glauconite in the Merchantville Formation.

- Other inorganic analytes, including cadmium, nickel, and mercury, exceeded screening criteria. These analytes, although possibly related to site practices, were not found at high enough concentrations, or frequently enough, to be selected as site-related contaminants in the EPA RI.

- Concentrations of antimony and arsenic were also detected above the NRDCSRS on the Mira Trucking property. Concentrations of antimony were greater than 450 mg/kg in 4 samples, and concentrations of arsenic were greater than 19 mg/kg in 21 samples. In general, these areas with elevated antimony and arsenic concentrations were colocated with areas of lead concentrations in soil greater than the NRDCSRS.

PCBs

- PCBs were found in the scrapyard area and in the open field/waste disposal area, with the majority of contamination in the upper 4 feet as shown on RI Figure 4-6 in Appendix A. Aroclors 1016, 1248, 1254, 1260, and 1268 were detected, with Aroclor 1260 being the most prevalent in the open field/waste disposal area (at up to 540,000 micrograms per kilogram [µg/kg]). Aroclor 1260 was also the most prevalent in the scrapyard area (up to 260,000 µg/kg), based on the EPA RI. Aroclor 1254 was historically the predominant PCB in the scrapyard area (Louis Berger 2004). Historic reports suggested there may have been widespread application of a PCB-containing agent for dust and weed control on the unpaved roadways and lots that supported past waste disposal operations. A PCB-containing material may also have been mixed in with the waste that was buried at the area.

- Concentrations of Aroclor 1254 were detected above 1,000 µg/kg in in four samples on the Mira Trucking property. These elevated concentrations of Aroclor 1254 were colocated with areas of lead concentrations in soil greater than the NRDCSRS.

Other Contaminants

- Benzo(a)pyrene exceeded the RI screening criterion in numerous surface soil samples; however, the distribution pattern is not similar to the site-related metals or PCBs. Only one sample collected at the rental home area was found elevated at several orders of magnitude above the screening criteria. The distribution on the rest of the site suggests the other levels are consistent with levels often found in urban soils.

- Dioxins were elevated in the surface soil samples collected adjacent to the waste disposal areas, with a maximum concentration of 96.8 nanograms per kilogram (ng/kg). Dioxins were not a risk driver based on the risk assessment and were not selected as site-related contaminants.

1.6.3 Summary of Sediment Contamination

The extent of contamination and range of concentrations for lead, antimony, copper, zinc, and PCBs (represented as Aroclor 1254) in sediment are presented on RI Figures 4-7 to 4-12 in

Appendix A, respectively. The soils below mean high tide and in the mudflats are considered to be sediments.

- Lead, antimony, copper, and zinc contamination is generally concentrated in the upper 3 feet of sediments immediately adjacent to the battery casing disposal areas. Lower concentrations of these contaminants above the ecological screening criteria were found throughout the mudflats or tidal wetlands. These lower detections may be due to local background concentrations or the mobilization of contaminated sediments by tidal flow.

- Lead was detected as high as 35,200 mg/kg (at T-13E from 1 to 2 feet below the sediment surface) in the vicinity of the battery casing disposal areas. Farther from the battery casing disposal areas into the mudflats along Hessian Run, lead concentrations significantly decreased to a range of 100 to 300 mg/kg.

- Antimony was detected at up to 37.2 mg/kg (T9-E from 0 to 0.5 foot); copper at up to 195 mg/kg (T14-E from 1 to 1.5 feet below the sediment surface); and zinc at up to 1,750 mg/kg (T7-E from 0 to 0.5 foot). These high detections were also concentrated in the area adjacent to the battery casing disposal areas.

- Arsenic, iron, chromium, and barium exceeded the screening criteria throughout the drainage basin but are likely concentrated in sediments due to the presence of glauconite-rich soils in the Merchantville Formation, which makes up the substrate of portions of both creeks.

- Other inorganic analytes were found slightly above criteria, but their random distribution and concentrations not significantly above background concentrations did not suggest attribution to the site.

- PCBs, primarily Aroclor 1254, were concentrated in the upper 3 feet of sediment samples throughout both Hessian Run and Woodbury Creek. Aroclor 1254 was detected up to 19,600 µg/kg during the NJDEP RI and up to 850J µg/kg during EPA's RI. While the most elevated concentrations are immediately adjacent to the site within Hessian Run, the distribution throughout the drainage basin is more varied.

- Dioxin concentrations exceeded screening criterion in all four sediment samples collected during the EPA RI, with a maximum of 6.57 ng/kg.

1.6.4 Summary of Seep/Sediment Porewater Contamination

Contaminants detected in seep and porewater samples demonstrated a transport pathway of contaminants from waste materials and contaminated soils into surface water bodies and sediment whether the contaminants are related to background (glauconite) conditions or site activities. Results of seep and porewater samples are presented on RI Figure 4-13 in Appendix A.

- High levels of site-related dissolved contaminants were observed in seep and porewater samples collected during the EPA RI, particularly at the eight locations adjacent to the battery casing disposal areas. In seep samples, total lead concentrations ranged from 67.1J to 251,000J micrograms per liter (µg/L) while dissolved lead concentrations ranged from

2.1 to 802 µg/L; in porewater samples, total lead concentrations ranged from 340J to 11,100 µg/L while dissolved lead concentrations ranged from 0.82J to 456 µg/L. At the other two locations along Woodbury Creek upstream or downstream of the battery casing disposal areas, total and dissolved lead concentrations were significantly lower in both the seep samples and porewater samples.

- Copper, zinc, and antimony all exceeded the RI screening criteria to some extent. Total copper was detected as high as 564 µg/L in seep samples and 58.6 µg/L in sediment porewater samples. Total zinc was detected as high as 25,700J µg/L in seep samples and 6,740J µg/L in sediment porewater samples. Total antimony was detected as high as 12.2 µg/L in seep samples but did not exceed the RI screening criterion in sediment porewater samples.
- Concentrations of Aroclor 1254 also exceeded the RI screening criterion, reaching 0.62J µg/L in seep samples and 1.1 µg/L in sediment porewater samples.
- Concentrations of site-related contaminants were highest in seep sample SEEP-8 for total lead, total zinc, and PCBs and highest in porewater sample SGS-5 for total lead and total zinc. Both samples were from waste disposal areas or immediately adjacent to the waste disposal areas.
- Geochemical conditions at the site (anaerobic conditions with low groundwater pH) may result in the dissolution of metals such as arsenic, iron, and vanadium that are naturally present in subsurface soil.
- Contaminant levels in filtered samples are lower than in the unfiltered samples, indicating the majority of contamination is associated with the suspended solids in each sample.
- The site-related contaminant concentrations were generally higher in seep samples compared to porewater samples, suggesting that the primary source of contamination in these media is due to direct weathering from the waste disposal areas, whereas leaching from the waste piles into sediment and surface water is a secondary pathway for contaminant transport.

1.6.5 Summary of Surface Water Contamination

Surface water samples had limited exceedances of site-related contaminants as shown on RI Figure 4-14 in Appendix A.

- During the EPA RI, total lead exceeded the surface water criterion of 5 µg/L in six samples. The highest total lead concentrations were in the two background samples located upstream of the site in Hessian Run. The highest total lead concentration adjacent to the battery casing disposal areas was 7.1 µg/L at T14-SW-01. The dissolved lead concentrations ranged from non-detect to 2J µg/L, lower than the surface water criterion, indicating the lead was associated with the suspended solids in the surface water samples.
- Elevated concentrations exceeding surface water screening criteria of all site-related contaminants were detected in the unfiltered surface water sample, T1-SW-01, which is a

background location. It is unclear if this location has been influenced by site contamination through tidal flow.

- Elevated concentrations of copper and lead also exceeded the surface water screening criteria in the second background location, T31-SW-01.
- PCBs did not exceed the surface water screening criteria in any surface water samples.
- The contaminant levels in filtered samples are lower than in the unfiltered samples, indicating that the limited contamination is primarily in sediments entrained in the surface water.
- SVOC detections were limited to the upgradient ditch adjacent to Interstate 295.

1.6.6 Summary of Groundwater Contamination

Groundwater sample results exceeding the RI screening criteria are shown on RI Figures 4-15 to 4-18 in Appendix A.

- Total lead concentrations exceeded the groundwater screening criterion of 5 µg/L at five well locations, whereas dissolved lead only exceeded the criterion at one location, MW-05. Among the five well locations with lead exceedances, three are in the immediate vicinity of battery casing disposal areas and found slightly elevated lead concentrations; MW-05, located within a battery casing disposal area, had total and dissolved lead concentrations as high as 573J and 43.3 µg/L, respectively. The other location, MW-21S, is upgradient of the site. Compared to the lead level observed during the NJDEP RI, lead concentrations in MW-05 have significantly decreased. NJDEP detected total lead (unfiltered) and dissolved lead (filtered) at 6,050 and 3,290 µg/L, respectively, in December 2000. The lead concentration was 1,320 µg/L in January 2011. Therefore, it seems likely that natural processes have significantly reduced the leaching of lead from the crushed battery casings into groundwater over that time period.
- Total lead concentrations in groundwater screening samples exceeded the criterion of 5 µg/L at 2 of the 13 boring locations (GW-06 and GW-03). These exceedances were at localized areas in which elevated lead concentrations were likely associated with turbid samples.
- Antimony exceeded the groundwater screening criterion of 6 µg/L at one location, MW-18S, in which the total and dissolved antimony were 400 and 389 µg/L, respectively. This well is not located within the battery casing disposal areas.
- Several other inorganic analytes (iron, arsenic, aluminum, and manganese) exceeded RI groundwater screening criteria. Overall, total levels were higher than dissolved levels, and the deep regional aquifer had higher levels than the shallow perched zone, which is likely due to the anaerobic geochemistry of the deep aquifer and the presence of glauconitic soils of the Merchantville Formation. The distribution of these analytes does not indicate they are related to disposal practices at the site.

- A vinyl chloride plume, as shown on RI Figure 4-14 in Appendix A, is present in the deep regional aquifer, with the highest levels off-site to the southeast at up to 36 µg/L in MW-20D. Vinyl chloride was detected in 1 of 17 shallow monitoring well samples but not in any other media on-site, suggesting that the vinyl chloride plume is not associated with past disposal practices at the site. The vinyl chloride plume in the deep regional aquifer appears to originate to the northwest of the site and flows with the regional groundwater toward the east/southeast (beneath the site).

- Tetrachloroethene (PCE) and trichloroethene (TCE) were detected in monitoring wells upgradient to the east of the site in the shallow perched aquifer. PCE and TCE were not site-related and were not detected at concentrations exceeding the groundwater screening criteria in any of the monitoring wells on-site. The source of this contamination is likely off-site to the east of the site.

- PCBs were not detected in the groundwater.

- The three potable wells on or adjacent to the site (located at the rental home, the Matteo scrapyard weigh station, and the former Billy-O-Tire) do not appear to be affected by site-related contaminants as only aluminum, iron, manganese, and sodium were detected above the New Jersey Drinking Water Standards in the 2012 and 2018 investigations.

1.7 Conceptual Site Model

The CSM was developed to integrate the various types of information collected during the RIs, including geology, hydrogeology, site background and setting, and the fate and transport of contaminants associated with the site. A visual representation of the CSM is presented in Figure 1-6.

Two types of contaminants are related to past site operations: metals (lead, copper, antimony, and zinc) and PCBs. Historically, the on-site incinerator reclaimed lead and copper from automotive batteries (lead-acid batteries) and recycled wire. Crushed battery casings and ash from the incinerator were disposed of along the shoreline of Hessian Run. The improper handling and disposal of lead-acid batteries contaminated surface and subsurface soils, sediment along the shoreline of Hessian Run, and groundwater in localized areas of battery casings. These battery casings mixed with municipal waste, soil, and sediment are source materials because they serve as a continued source of contamination to soil, sediment, and groundwater. PCB contamination was widespread in the open field/waste disposal areas, along the unpaved road, and in some of the scrapyard and battery casing disposal areas. The distribution and types of PCBs suggest widespread application of a PCB-containing product, possibly for dust and weed control. PCBs detected in the tidal wetland may not be solely related to the site, as noted in the NJDEP RI report (Louis Berger 2004), because historical aerial photographs show disturbance and landfilling on several properties surrounding the estuary as well as the presence of a nearby petroleum refinery located along an upstream tributary of Hessian Run.

PCBs are insoluble and have strong affinities for soil and sediment, making them relatively immobile and persistent in soil and sediment for a long time. Physical transport (e.g., erosion) is expected to be the primary transport mechanism for PCBs.

The lead-acid batteries usually contained elemental lead, lead oxide, lead sulfate, and dilute sulfuric acid solution. Improper handling of batteries in the crushing operation would have released lead sulfate and sulfuric acid onto the ground surface. Depending on the quantity of sulfuric acid released and the soil neutralization capacity, the acid would be neutralized gradually as it infiltrated downward into soil. Where the acid reacted with the soil or scrap metal on the ground surface or metal-containing waste, the low pH would have increased the solubility of metals or dissolved the metals, resulting in migration of metals into surface soil and subsurface soil. In a lead-acid battery, lead sulfate would approach its solubility in the dilute sulfuric acid. Once the soluble lead sulfate was released to the soil, the pH would increase, and lead sulfate would precipitate. Therefore, most of the lead contamination would be retained in the shallow soil. At locations with relatively large quantities of released acid, lead and other metals would have infiltrated to deeper depths. The RI data demonstrated that the majority of lead contamination was found from 0 to 2 feet bgs while lead had migrated at a few locations to deeper depths.

The improper disposal of crushed battery casings along Hessian Run has contaminated the soil, sediment, perched groundwater, and surface water in direct contact with the acidic lead-containing waste. Test pits were dug during the NJDEP RI, and samples were collected from soil within 1 foot underneath the disposed battery casings and waste. Lead was detected as high as 24,300 mg/kg (in TP45) at selected locations (Louis Berger 2004). However, the lead contamination was not considered to extend far downward (Louis Berger 2004), and the battery casing waste was situated directly on top of silt and clay materials at most of the test pit locations. This low permeability material would limit the vertical migration of metal contamination.

Surface runoff during storm events and tidal flows are believed to have played an important role in contaminant transport, especially during the early stages of waste disposal along Hessian Run. Erosion of battery casing waste spread the battery casings upstream and downstream from the disposal areas in Hessian Run. Upstream of the waste disposal areas, elevated lead concentrations (up to 258 mg/kg, 1 to 2 feet below the sediment surface [Louis Berger 2004]) were detected in sediment close to Red Bank Avenue and in surface water sample T1-SW-01 (654 µg/L in the unfiltered sample). Downstream of the waste disposal areas, lead concentrations as high as 2,130 mg/kg were found in one sediment sample from 2 to 3 feet below the sediment surface, approximately 350 feet away from the nearest battery casing disposal area. Elevated lead concentrations (up to 518 mg/kg, 2 to 3 feet below the sediment surface) were also detected close to South Grove Avenue, past the confluence of Hessian Run and Woodbury Creek. A review of vertical lead distribution data in the northern portion of Hessian Run shows that, in many locations, lead concentrations were higher in samples collected between 1 and 3 feet below the sediment surface as compared to samples collected between 0 and 0.5 foot below the sediment surface. This indicates deposition of less contaminated sediment in some areas of the mudflats. Fifty feet away from the battery casing disposal areas, lead contamination was generally found at low levels (less than 300 mg/kg) in the mudflats of Hessian Run.

Infiltration water in direct contact with the battery casing disposal areas and the perched groundwater that flows through the battery casing disposal areas have been contaminated with metals (such as lead) and discharged to Hessian Run as seeps during low tide. In addition to migration in the dissolved phase, metal contaminants have also migrated to the Hessian Run mudflats as suspended solids in the seeps as evidenced by the higher contaminant concentrations in unfiltered seep samples. The migration of lead via seeps is considered to be a major ongoing pathway for contaminant transport. The migration of metals at high concentrations into the mudflats was found to be at a limited distance along the bank of Hessian Run, which may be related to the low flow rates of tidal water and settlement of suspended solid near the bank of Hessian Run. It should be noted that during major storm events, both flow rates of tidal water and surface runoff are anticipated to be much higher than normal, which may cause redistribution of contaminants in Hessian Run mudflats.

During both RIs, tidal fluctuations were found to have minimal or no impact to the water levels in the perched groundwater system. In fact, water levels in the perched groundwater were found to be higher than the high tide in Hessian Run. Therefore, dissolved metals in the battery casing disposal areas would not be able to migrate inland during high tides.

The CSM for Mira Trucking is based on information obtained by EPA during the remedial action at the Birchly Court Site (OU2) and analytical data collected during EPA's 2017 investigation. Information indicated that crushed battery casings were disposed of on the property during battery recycling operations at the Matteo property. The battery casings contained lead-acid and caused lead contamination in the soils at the property. Lead-acid typically contains elemental lead, lead oxide, lead sulfate, and dilute sulfuric acid solution. The sulfuric acid increases the mobility of lead in soils. Depending on the quantity of sulfuric acids remaining on the battery casings and the soil neutralization capacity, the acid would be neutralized gradually as it infiltrated downward into soil. Therefore, most of the lead contamination would be retained in the shallow soils at the site.

1.8 Cultural Resources Survey

A phase IA cultural resources survey was conducted by Hunter Research, Inc., with oversight by CDM Smith, to identify the presence of cultural resources within the study area (CDM Smith 2018a). The survey was performed as a requirement of Section 106 of the National Historic Preservation Act of 1966, as amended, and meets the standards of the New Jersey Historic Preservation Office.

The fieldwork for this survey was conducted in October 2011. A site investigation confirmed the documented location and likely survival of archaeological resources relating to two former farmsteads, the Browning and Westcott sites, identified within the Matteo property, and the Wilkins Farmstead site on the Willow Woods property. A zone along the western side of the Matteo property, which was not affected by post-World War II industrial development, was considered likely to contain evidence of prehistoric occupation. Finally, two meadow banks or dikes located in the Woodbury Creek floodplain at the western end of the Matteo property were considered potentially significant as examples of historic land use.

Performance of a limited phase IB cultural resources survey was recommended, based on the results of the Phase IA survey, for the two farmstead sites on the Matteo property and in the zone of prehistoric sensitivity (Appendix C). Deep machine-assisted testing was also recommended at the Westcott farmstead to assess the preservation of pre-mid-20th century soils below the fill levels.

1.9 Risk Assessment

1.9.1 Human Health Risk Assessment

As part of the RI/FS, CDM Smith conducted an HHRA to characterize potential health risks associated with site media in the absence of any remedial action (CDM Smith 2016). The risk assessment did not include the Mira Trucking property, which was added to OU1 at a later date. Contaminants in soil, groundwater, surface water, sediment, and fish tissue were evaluated for potential health threats to the following receptors under current and future land-use scenarios.

- Current Land-Use Scenario
  - Matteo Property – site workers, trespassers, recreational users, anglers, and residents in the rental house
  - Willow Woods Property – residents
- Future Land-Use Scenario
  - Matteo Property – site workers, trespassers, recreational users, anglers, residents, and construction workers
  - Willow Woods Property – residents and construction workers

Chemicals of potential concern (COPCs) were identified based on criteria outlined in EPA's risk assessment guidance for superfund (RAGS) (EPA 1989), primarily through comparison to risk-based screening levels. Exposure routes and human receptor groups were identified, and quantitative estimates of the magnitude, frequency, and duration of exposure were made. Exposure point concentrations were estimated using the lower of the upper confidence limit (UCL) and the maximum detected concentration. Daily intakes were calculated based on the reasonable maximum exposure (RME) scenario (the highest exposure reasonably expected to occur at the site). The intent was to estimate a conservative exposure case that is still within the range of possible exposures. Central tendency exposure (CTE) assumptions were also developed, which reflect more typical exposures when the RME assumptions result in risk estimates above EPA's threshold.

Exposure pathways evaluated for soil included incidental ingestion, dermal contact, and inhalation of particulates by site workers, trespassers, recreational users, residents, and construction workers. Exposure pathways evaluated for groundwater included ingestion, dermal contact, and inhalation of vapor released during showering and bathing by current and future residents at the Matteo property. Exposure pathways evaluated for surface water and sediment included incidental ingestion and dermal contact by trespassers and future residents. The exposure pathway evaluated for fish was ingestion by anglers and future residents at the Matteo property.

Risk characterization integrates the exposure and toxicity assessments into quantitative expressions of risks/health effects. To characterize potential noncancer health effects, comparisons were made between estimated intakes of substances and toxicity thresholds. Potential cancer effects were evaluated by calculating probabilities that an individual will develop cancer over a lifetime exposure based on projected intakes and chemical-specific dose-response information. In general, EPA recommends target risk values or ranges (i.e., cancer risk of 1×10^{-6} to 1×10^{-4} or noncancer hazard index [HI] of 1) as threshold values for potential human health impacts (EPA 1989). These target values aid in determining whether additional response action is necessary at the site.

Cancer Risks

Under the RME scenario, the estimated total cancer risks under current land use for all current receptors are below, within, or at EPA's target range of 1×10^{-6} to 1×10^{-4}, except for residents at the Matteo property (rental home residents), site workers, and adult anglers. The total cancer risks for current residents (1×10^{-2}), site workers (3×10^{-4}), and adult anglers (2×10^{-4}) exceed EPA's target range. The cancer risk for current residents at the Matteo property is attributed to carcinogenic polyromantic hydrocarbons (cPAHs) in surface soil and arsenic and vinyl chloride in groundwater. These chemicals are not considered site-related. The risk drivers for current adult anglers are attributable to PCBs in fish. The risk driver for site workers is Aroclor 1260 in surface soil. When a more typical exposure is considered under the CTE scenario, the total cancer risks for site workers and adult anglers are within EPA's target range. However, the total cancer risk for current residents at the Matteo property ($4x10^{-3}$) is still above EPA's target range and the risk drivers are not site-related.

Estimated risks for future site workers, trespassers, recreational users, anglers, and residents at the Willow Woods property remain the same as those for the current land-use scenarios. The estimated total cancer risks for construction workers at Willow Woods property are below EPA's target range. For future residents at the Matteo property, the estimated total cancer risk under both the RME scenario (6×10^{-3}) and the CTE scenario (2×10^{-3}) still exceeds EPA's target range. Cancer risks for future residents are due to exposure to cPAHs and Aroclor 1260 in soil, cPAH in surface water, arsenic and vinyl chloride in groundwater, and PCBs in fish. With the exception of PCBs, none of the chemicals identified as cancer risk drivers for current or future residents are considered site-related.

Noncancer Risks

In the evaluation of noncancer health hazards under the RME scenario, the HIs for current and future recreational users, current and future Willow Woods residents, and future construction workers within Willow Woods are below EPA's threshold of unity. However, current and future site workers, current and future trespassers, current and future residents, and future construction workers at the Matteo property (including rental home) and current and future anglers at Woodbury Creek and Hessian Run have noncancer HIs greater than the EPA threshold. Under the CTE scenario, current and future residents at Matteo property, site workers, and child anglers still have noncancer HIs greater than the EPA threshold of 1. These potential health hazards are due to exposure to antimony, arsenic, iron, and vanadium in groundwater, Aroclor 1260 and vanadium in soil, and Aroclors 1254 and 1260 in fish.

The mean lead concentrations in sediment did not exceed EPA screening level. The mean lead concentrations in soils at the Matteo property and the open field/waste disposal area, groundwater, and surface water and fish of Hessian Run and Woodbury Creek exceed EPA screening levels. Potential exposure to lead in these media and through consumption of fish caught from Hessian Run and Woodbury Creek may cause adverse health effects to site workers, trespassers, recreational users, residents, anglers, construction workers, and especially future residents at the Matteo property.

In summary, there is potential for unacceptable health risks to current and future residents at the Matteo property and anglers consuming fish caught in Hessian Run and Woodbury Creek. Risks are overestimated for current residents at the Matteo property from potential use of groundwater for drinking water. Based on the RI data, all risk drivers identified in groundwater were either not detected in the potable wells or were present at levels below federal Maximum Contaminant Levels and state groundwater standards in potable wells at the rental house. Thus, current exposure to groundwater is not a concern for residents at the rental house. Lead, antimony in groundwater, and PCBs in fish were identified as risk drivers related to the Matteo site. Risks attributable to arsenic, iron, vanadium, cPAHs, and vinyl chloride are most likely due to sources unrelated to the Matteo site. Tables 1-1 and 1-2 summarize the human health risks.

Risk at Mira Trucking

Human health risk associated with exposure to lead in surface soil on the Mira Trucking property and adjacent residential property (P002) was evaluated in the Matteo OU1 RI addendum (CDM Smith 2019). While additional contaminants had high concentrations relative to NRDCSRS (e.g., arsenic, antimony, and Aroclor 1254), the elevated concentrations were all colocated with high lead concentrations. As such, lead was considered the primary COPC to be evaluated for human health risk on the Mira Trucking property.

The evaluation concluded that lead concentrations in surface soil on the Mira Trucking property pose an elevated risk because more than 5% of the exposed populations could have blood lead concentrations that exceed the blood lead level reference value of 5 micrograms per deciliter (µg/dL). Since the Mira Trucking property is zoned commercial, the adult lead methodology model spreadsheet was used in this evaluation to assess the risk to current and future workers. In addition, on the adjacent residential property (P002), the evaluation concluded that lead in surface soil poses an elevated risk because more than 5% of the population incidentally ingesting soil could have blood lead concentrations that exceed 5 µg/dL. For this evaluation, the integrated exposure uptake biokinetic model for lead in children was used because the property was residential.

1.9.2 Screening Level Ecological Risk Assessment

As part of the RI/FS, CDM Smith conducted a screening level ecological risk assessment (SLERA) to evaluate the potential for ecological risks at the Matteo site (CDM Smith 2018b). Prior to performing the assessment, CDM Smith contacted the United States Fish and Wildlife Service (USFWS) and NJDEP to identify threatened and endangered species that may exist at or near the site. The USFWS reported the historic occurrence of swamp pink (*Helonias bullata*), a threatened species, within West Deptford Township, but further review of habitat requirements indicate that suitable habitat is not present at the Matteo site to support swamp pink. No federally listed or proposed threatened or endangered species are known to exist within the vicinity of the site. The NJDEP Natural Heritage Program reported the occurrence of the great blue heron (*Ardea herodias*), a species of special concern, near the site. No other species or communities of concern were noted on or within 1/4 mile of the site.

A prior ecological investigation was conducted by Louis Berger on behalf of NJDEP (Louis Berger 2004). The investigation focused primarily on aquatic portions of the site but also included select upland areas. Subsequently, Lockheed Martin, under a Response Engineering and Analytical Contract (REAC) to EPA's Environmental Response Team, conducted a desktop ERA using the data collected during the NJDEP investigation (Lockheed Martin/REAC 2005). This ERA identified a link between site contaminants and adverse effects to terrestrial and aquatic receptors/communities and noted that wildlife utilizing areas of highest site-related contamination for foraging were at risk.

The SLERA conducted by CDM Smith evaluated exposure of ecological receptors to chemicals in site media through direct contact and dietary habits. Data used in the SLERA were collected during the EPA RI. Media evaluated included soil, sediment, surface water, porewater, and seep water. Direct exposure risks were evaluated through a comparison of maximum concentrations of chemicals in site media to their respective ecological screening levels (ESLs). Where maximum concentrations exceeded the respective ESLs, a hazard quotient (HQ) greater than 1 was calculated, indicating a potential risk. Using this process, potential ecological risks from direct exposure to the following media-specific contaminants were identified.

- Soil
  - SVOCs: benzo(a)anthracene
  - Pesticides: 4,4'-dichlorodiphenyldichloroethylene (DDE), 4,4'-dichlorodiphenyltrichloroethane (DDT), dieldrin, and endrin
  - PCB Aroclors: Aroclor 1248, Aroclor 1254, and Aroclor 1260
  - Dioxins/Furans: dioxins/furans (based on total toxicity equivalents [TEQs])
  - Inorganics: antimony, cadmium, chromium, copper, lead, manganese, mercury, nickel, vanadium, and zinc
- Sediment
  - PCB Aroclors: Aroclors 1248, 1254, and 1268
  - PCB Congeners: dioxin-like congeners (PCB 77, 105, 118, 126, 156, 167, and 169) and total sum of all detected congeners
  - Dioxins/Furans: dioxins/furans (based on total TEQs)
  - Inorganics: antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc
- Surface water
  - SVOCs: benzo(a)anthracene, benzo(a)pyrene, and bis(2-ethylhexyl)phthalate
  - Pesticides: 4,4'-dichlorodiphenyldichloroethane (DDD) and gamma-chlordane

    - Inorganics (total): aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, silver, vanadium, and zinc
    - Inorganics (dissolved): iron and manganese
- Porewater
    - Pesticides: 4,4'-DDE
    - PCB Aroclors: Aroclor 1254
    - Inorganics (total): aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, cyanide, iron, lead, manganese, nickel, vanadium, and zinc
    - Inorganics (dissolved): aluminum, barium, cadmium, chromium, iron, lead, manganese, vanadium, and zinc
- Seep water
    - PCB Aroclors: Aroclor 1254
    - Inorganics (total): aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, cyanide, iron, lead, manganese, nickel, vanadium, and zinc
    - Inorganics (dissolved): aluminum, cadmium, copper, iron, lead, manganese, nickel, and zinc

The following contaminants were detected, but risks could not be concluded because ESLs are not available.

- Soil
    - SVOCs: 1,1'-biphenyl, benzaldehyde, carbazole, and dibenzofuran
    - Inorganics: aluminum and iron
- Sediment
    - Inorganics: beryllium, thallium, and vanadium
- Surface water
    - SVOCs: benzo(k)fluoranthene and chrysene
- Porewater
    - SVOCs: caprolactam

Dietary exposure risks were identified using food chain models for bioaccumulative chemicals detected in sediment and soil. The HQ method was employed, comparing total dose to toxicity reference values (TRVs) for each species evaluated. Dose was calculated using conservative life history and exposure parameters, and TRVs were based on the no observed adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL). Where total dose exceeded the TRV, an HQ greater than 1 was calculated. For NOAEL-based TRVs, an HQ less than 1 suggests a lack of risk; for LOAEL-based TRVs, an HQ greater than 1 implies risk. Where the NOAEL-based HQ is greater than 1 but the LOAEL-based HQ is less than 1, there is potential for risk.

Ten species representing the avian and mammalian communities inhabiting the site were evaluated using food chain exposure modeling, and calculated risks are summarized below.

- Bald eagle
  - Risk from exposure to lead
  - Potential risk from exposure to zinc
- Great blue heron
  - Risk from exposure to lead
  - Potential risk from exposure to selenium and zinc
- Mink
  - Risk from exposure to arsenic, lead, selenium, and total PCB congeners
  - Potential risk from exposure to copper, zinc, Aroclor 1248, and dioxin/dioxin-like compounds
- Muskrat
  - Risk from exposure to arsenic and lead
- Wood duck
  - Risk from exposure to lead
  - Potential risk from exposure to zinc
- Raccoon
  - Potential risk from exposure to arsenic, lead, and Aroclor 1248
- American robin
  - Risk from exposure to copper, lead, zinc, 4,4'-DDE, 4,4'-DDT, gamma-chlordane, dieldrin, endrin, and Aroclors 1248, 1254, and 1260
  - Potential risk from exposure to cadmium, benzo(a)anthracene, benzo(b)_fluoranthene, benzo(k)fluoranthene, chrysene, delta-BHC, and dioxins furans.
- Short-tailed shrew

  - Risk from exposure to lead, zinc, gamma-chlordane, endrin, Aroclors 1248 and 1260, and dioxins/furans
  - Potential risk from exposure to arsenic, cadmium, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dieldrin, and Aroclor 1254
- Red-tailed hawk
  - Risk from exposure to lead and 4,4'-DDT
  - Potential risk from exposure to zinc, 4'4-DDE, and Aroclors 1248 and 1260
- Red fox
  - Risk from exposure to lead and Aroclor 1248
  - Potential risk from exposure to arsenic, dieldrin, Aroclors 1254 and 1260, and dioxins/furans

In summary, the SLERA determined that there are contaminants in all site media at levels that may cause adverse effects to ecological receptors, via both direct exposure and dietary exposure. Multiple chemicals were determined to be risk drivers, but lead was the most prominent, affecting all site media and causing risk via both direct and dietary exposure.

1.9.3 Step 3a Ecological Risk Assessment

The findings of the SLERA served as a basis of scientific management decision point to determine the next steps in the ecological risk assessment process. The next step, specifically, Step 3a, was conducted to refine the list of COPCs that were identified in the SLERA. This step of the risk assessment process initiates the problem formulation phase of the baseline ecological risk assessment and uses less conservative assumptions to characterize risks.

Results of the Step 3a evaluation indicated fewer risks from exposure to chemicals detected in site media when compared to the SLERA. Metals continue to be the primary risk driver in all site media based on direct exposure. Dioxins/furans, pesticides, and PCBs also pose a risk; however, exceedances of ecological screening levels for PCB Aroclors in soil and sediment were minimal. Due to the limited number of samples and detected concentrations, 95% UCLs could not be calculated for dioxins and PCBs in sediment and pesticides in soil, and maximum concentrations were used. The use of maximum values as exposure point concentrations most likely overestimates risks.

Chemicals present in sediment pose little risk to ecological receptors based on food chain exposure models. The only exception was exposure to lead for piscivorous birds based on the great blue heron model where an HQ of 1.2 was calculated. Such a low HQ is not necessarily indicative of minimal risk because of varying degrees of uncertainty in the model and TRVs used. However, it can be suggested that minimal risk exists since the daily dose of lead calculated is so close to the toxicity reference value to which it is compared. In addition, despite less conservative assumptions in the models when compared to the SLERA, conservative assumptions are still used such as a site foraging factor of 1.0 and assuming the great blue heron's diet consists only of fish. Based on this, risk from exposure to lead in sediment is most likely overestimated.

Chemicals identified as risk drivers in soil based on food chain exposure models consist primarily of the site-related metals lead and zinc. Pesticides, PCB Aroclors, and dioxins were also noted as risk drivers based on the American robin and short-tailed shrew models used to represent insectivorous birds and mammals. Except for gamma-chlordane and endrin, model results for these pesticides produced relatively low HQs (not exceeding 7), suggesting minimal risk.

Section 2

Development of Remedial Action Objectives and Screening of Technologies

RAOs are media-specific goals for protecting human health and the environment. They serve as the basis for the development of remedial action alternatives and specify what the cleanup action will accomplish. The process of identifying the RAOs follows the identification of affected media and contaminant characteristics and evaluation of exposure pathways, contaminant migration pathways, and exposure limits to receptors. To achieve the RAOs, preliminary remediation goals (PRGs) were developed as the benchmarks in the technology screening process and the development, screening, and detailed evaluation of alternatives.

PRGs are developed based on federal- or state-promulgated ARARs, risk-based levels (human health and ecological), and background concentrations, with consideration also given to other factors such as analytical detection limits and guidance values.

Data from the final RI report (CDM Smith 2018a), the NJDEP final RI report (Louis Berger 2004), and the 2005 RASE report (Louis Berger 2005), along with the CSM described in Section 1, were used for the screening, evaluation, and selection of remedial technologies and development, screening, and evaluation of remedial action alternatives in accordance with CERCLA.

Section 121(d) of CERCLA, as amended, requires that any remedial action must, at a minimum, achieve overall protection of human health and the environment and comply with ARARs. Other criteria that do not meet the definition of an ARAR are known as “to be considered” (TBC) criteria, which may also be used to develop PRGs and considered during evaluation of remedial alternatives.

The remedial action alternatives developed in subsequent sections of this FS are required to attain applicable federal, State of New Jersey, and local environmental requirements. Technical requirements of the ARARs must be met by the remedial action alternatives. However, 40 Code of Federal Regulations (CFR) 121(d)(4) allows selection of remedies that will not attain all ARARs, provided one of the conditions listed below is satisfied.

- The remedial action is an interim measure where the final remedy will attain the ARARs upon completion.
- Compliance with all ARARs will result in greater risk to human health and the environment than other options.
- Compliance with all ARARs is technically impracticable.
- The remedial action will attain the equivalent of the ARARs.

- For state requirements, the state has not consistently applied the requirement in similar circumstances.
- Compliance with the ARARs will not provide a balance between protecting public health, welfare, and the environment at the site and the availability of funding for response at other facilities (fund balancing).

ARARs apply to actions or conditions located on- and off-site. On-site actions implemented under CERCLA are exempt from administrative requirements of federal and state regulations (such as permits), if the substantive requirements of the ARARs are met. Off-site actions are subject to the full requirements of the applicable standards or regulations (including all administrative and procedural requirements).

2.1 Development of Remedial Action Objectives

A detailed discussion of the contaminants, media of concern, and the RAOs for all impacted media are presented in this section.

2.1.1 Identification of Site-Related Contaminants

The final RI report identified four inorganic contaminants (lead, copper, zinc, and antimony) and PCBs (Aroclor 1254, Aroclor 1260, and Aroclor 1248) as site-related contaminants of concern (COCs). Other inorganics, including arsenic, iron, manganese, and vanadium, exceeded the RI screening criteria but are likely concentrated in soil due to the presence of naturally occurring glauconite in the Merchantville Formation. Benzo(a)pyrene was also detected at concentrations exceeding the RI screening criterion; however, the concentrations were consistent with urban soils. Copper did not exceed NJDEP NRDCSRS in the commercial zoned areas or RDCSRS in the residential zoned areas and is not an ecological risk driver. Antimony exceeded the NJDEP NRDCSRS in soils in the open field waste disposal area and was identified as a risk driver in the human health risk assessment for its presence in groundwater. Furthermore, the human health risk assessment and step 3A ecological risk assessment indicated that lead, zinc, and PCBs are the risk drivers. Therefore, in this FS, the site-related contaminants to be remediated include lead, zinc, antimony and PCBs in soil and groundwater.

2.1.2 Identification of Contaminated Media

Five impacted media were identified at this site: source materials (battery casings mixed with municipal waste, soil, and sediment); soil; sediment; groundwater; and surface water. Sediment and surface water contamination would be addressed under OU3 and will not be evaluated as part of this FS.

<u>Source Materials and Principal Threat Waste</u>

Crushed battery casings and battery casings mixed with general waste were disposed of along the southern banks of Hessian Run. The ashes from the incinerator and the "sweating fire box" were likely disposed of with the crushed battery casings. The improper handling and disposal of battery casings has contaminated soil, waste, sediment, and groundwater and surface water at localized areas. Consequently, the battery casings mixed with municipal waste, soil, and sediment are considered source materials that continue to serve as sources of contamination to groundwater as elevated lead concentrations were detected in porewater samples and seep samples; to sediments through transport of particulates with tidal water and stormwater runoff; to surface soil through wind entrainment.

Battery casings were also identified at the Mira Trucking property during the 2017 and 2018 EPA investigations. The battery casing material was found to consistently contain high lead concentrations and was identified as the source of lead contamination in soil at the Mira Trucking property.

Principal threat wastes are identified by the NCP (40 CFR 300.430) as source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

For this site, the battery casings containing source materials exhibit elevated concentrations of lead and are characteristically hazardous (D-008 for lead). They serve as a continued source of contamination to soil, sediment, and potentially groundwater through wind entrainment, stormwater runoff, inundating tidal water, and infiltration from precipitation. Therefore, these source materials are considered principal threat waste.

Soil
Surface and subsurface soil contaminated with lead and PCBs pose risks to human health; soil contaminated with lead, zinc, and/or PCBs poses risks to ecological receptors. Metals contamination was not found to be directly associated with the general waste, but elevated PCB levels were found in the general trash disposal areas. PRGs need to be developed to remediate the contaminated soil to protect human health and the environment.

Groundwater
Two groundwater flow systems are present at the site: shallow perched groundwater and deep regional groundwater. The shallow perched groundwater is contaminated with lead in three monitoring wells within or in the vicinity of the battery casing disposal areas. Therefore, once the battery casings are removed, lead concentrations in the perched groundwater are expected to decrease. During EPA's RI, only the sample from MW-05 had a dissolved lead concentration that exceeded the RI groundwater screening criterion of 5 μg/L. Furthermore, even within the battery casing disposal areas (MW-05), lead concentrations in groundwater observed during the EPA RI have decreased relative to the NJDEP RI data (CDM Smith 2018a), suggesting that lead is naturally attenuating to a less leachable form. One sample from MW-06D (out of 15 total samples from deep groundwater) had a total lead concentration of 12.2 μg/L but a dissolved lead concentration of only 0.2J μg/L. Based on these observations, no remedial action is considered necessary for the groundwater. However, PRGs for groundwater are developed for monitoring groundwater quality during and after remediation.

2.1.3 Remedial Action Objectives

Remedial action objectives were developed for source materials, soil, and groundwater. The remediation of source materials and contaminated soil is expected to decrease site-related contaminant concentrations in surface water and groundwater to meet the PRGs.

The RAOs for source materials are described below.

- Eliminate migration of contamination from the source materials to surface water, sediment, soil, and groundwater.
- Eliminate exposure to source materials to human and ecological receptors.

The RAOs for contaminated soils are described below.

- Reduce or eliminate exposure to contaminated soil at concentrations exceeding the PRGs by human and ecological receptors.
- Minimize or eliminate contaminant migration to sediment, groundwater, and surface water.

The RAOs for contaminated groundwater are described below.

- Reduce contaminant concentrations by remediating the source materials and contaminated soils exceeding the PRGs.

Groundwater quality will be monitored under OU1 to collect data that can be evaluated to support a future groundwater decision document.

2.2 Potential ARARs, Guidelines, and Other Criteria

As required under Section 121 of CERCLA, remedial actions carried out under Section 104 or secured under Section 106 must be protective of human health and the environment and attain the levels or standards of control for hazardous substances, pollutants, or contaminants specified by the ARARs of federal environmental laws and state environmental and facility siting laws, unless waivers are obtained. According to EPA guidance, remedial actions also must consider non-promulgated TBC criteria or guidelines if the ARARs do not address a particular situation.

The degree to which these environmental and facility siting requirements must be met varies, depending on the applicability of the requirements. Applicable requirements must be met to the full extent required by law. CERCLA provides that permits are not required when a response action is taken on-site. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) defines the term on-site as the areal extent of contamination and all suitable areas in close proximity to the contamination necessary for the implementation of the response action (40 CFR 300.5). Although permits are not required, the substantive requirements of the applicable permits must be met. On the other hand, only the relevant and appropriate portions of non-applicable requirements must be achieved and only to the degree that they are substantive rather than administrative in nature.

CERCLA requires that on-site remedial actions attain or waive federal environmental ARARs, or more stringent state environmental ARARs, upon completion of the remedial action. The purpose of ARARs is to define the minimum level of protection that must be provided by a remedy selected and implemented. Additional protection may be required, if necessary, to protect human health and the environment.

2.2.1 Definition of ARARs

Under CERCLA, as amended, a federal- or state-promulgated requirement may be either "applicable" or "relevant and appropriate" to a site-specific remedial action but not both. The distinction is critical to understand the constraints imposed on remedial alternatives by environmental regulations other than CERCLA.

2.2.1.1 Applicable Requirements

Applicable requirements pertain to those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are more stringent than federal requirements may be applicable. Applicable requirements are defined in the NCP at 40 CFR 300.5 – Definitions.

2.2.1.2 Relevant and Appropriate Requirements

Relevant and appropriate requirements pertain to those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site per se, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Relevant and appropriate requirements are defined in the NCP at 40 CFR 300.5 – Definitions.

The determination that a requirement is relevant and appropriate is a two-step process that includes: (1) the determination that the requirement is relevant and (2) the determination that the requirement is appropriate. In general, this involves a comparison of a number of site-specific factors, including an examination of the purpose of the requirement and the purpose of the proposed CERCLA action, the medium and substances regulated by the requirement and those involved in the proposed remedial action, the actions or activities regulated by the requirement and those involved in the remedial action, and the potential use of resources addressed in the requirement and the remedial action. When the analysis results in a determination that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA 1988).

2.2.1.3 Other Requirements To Be Considered

These requirements pertain to federal and state criteria, advisories, guidelines, or proposed standards that are not generally enforceable but are advisory and that do not have the status of potential ARARs. Guidance documents or advisory TBC criteria may be used to determine the necessary level of remediation to be protective of human health and/or the environment where no specific ARARs exist for a chemical or situation or where such ARARs are not sufficient to be protective.

2.2.1.4 Classification of ARARs

Three classifications of requirements are defined by EPA in the ARAR determination process: chemical-, location-, and action-specific. Additionally, TBC criteria are also evaluated. TBC criteria are not federally enforceable standards but may be technically or otherwise appropriate to consider in developing site- or media-specific PRGs.

Chemical-Specific ARARs and TBC Criteria
Chemical-specific ARARs include those laws and regulations governing the release of materials possessing certain chemical or physical characteristics or containing specified chemical compounds. These ARARs and TBC criteria usually are health- or risk-based values or methodologies. They establish acceptable amounts or concentrations of chemicals that may be found in, or discharged to, the ambient environment. They may also define acceptable exposure levels for a specific contaminant in an environmental medium. They may be actual concentration-based cleanup levels, or they may provide the basis for calculating such levels. Examples of chemical-specific ARARs are PCB cleanup values for soils under the Toxic Substances Control Act (TSCA) or Maximum Contaminant Levels specified for public drinking water that are applicable to groundwater aquifers used for drinking water. Table 2-1 summarizes the chemical-specific ARARs and TBCs identified for this site and their considerations for this FS.

Location-Specific ARARs and TBC Criteria
Location-specific ARARs are design requirements or activity restrictions based on the geographical or physical position of a site and its surrounding area. Location-specific requirements set restrictions on the types of remedial activities that can be performed based on site-specific characteristics or location. Examples include areas in a floodplain, a wetland, or a historic site. Location-specific criteria can generally be established early in the RI/FS process since they are not affected by the type of contaminant or the type of remedial action implemented. Table 2-2 summarizes the location-specific ARARs and TBCs identified for this site and their considerations for this FS.

Action-Specific ARARs and TBC Criteria
Action-specific ARARs are technology-based, establishing performance, design, or other similar action-specific controls and restrictions for particular remedial actions. These action-specific ARARs are considered in the screening and evaluation of various technologies and process options in subsequent sections of this report. Table 2-3 summarizes the action-specific ARARs and TBCs identified for this site and their considerations for this FS.

2.2.2 RCRA Land Disposal Restrictions Requirements, Area of Contamination, and Corrective Action Management Units

High concentrations of lead were detected in the contaminated soil and sediment at the site. Currently, there is no available documentation (i.e., manifests) indicating the exact origins of the battery casings or contaminated soil and sediment. Therefore, it is not possible to definitively identify whether these wastes are F-, K-, P-, or U-listed wastes. Since the battery casings and contaminated soil and sediment exceeded the toxicity characteristic leaching procedure (TCLP) regulatory limit for lead, all are classified as Resource Conservation and Recovery Act (RCRA) characteristic wastes (waste code D-008). As a result, disposal of the battery casings off-site will need to comply with RCRA land disposal restriction (LDR) requirements. The wastes will need to be treated such that the wastes no longer show the RCRA characteristic (i.e., the leachate concentration of lead is below the TCLP regulatory limit of 5 milligrams per liter [mg/L]). For contaminated soil and debris defined as hazardous (characteristic) waste, RCRA LDRs provide alternate treatment standards under 40 CFR 268.45 for contaminated debris and 40 CFR 268.49 for contaminated soil as described below:

- Debris (40 CFR 268.45 Table 1) – The alternate standards range from removing all contaminants with high pressure washing to encapsulating the debris to prevent hazardous constituents from leaching. Debris treated with these alternate treatment standards meets the LDR requirements and, in many cases, can be disposed of as non-hazardous waste.
- Soil (40 CFR 268.49) – The alternate soil treatment standards mandate reduction of any underlying hazardous constituents (UHCs) in the soil by 90% or 10 times universal treatment standards (UTS), whichever is higher. Removal of the characteristic is also required if the soil is ignitable, corrosive, or reactive. Treatment is required for each UHC, including PCBs. Generators can reasonably apply knowledge of the likely contaminants present and use that knowledge to select appropriate UHCs, or classes of constituents, for monitoring.

However, consolidation of the battery casings and contaminated soil and sediment in locations with similar types of contamination on-site will not trigger the RCRA LDR. According to the Area of Contamination (AOC) policy (EPA 1990), EPA interprets RCRA to allow certain discrete areas of generally dispersed contamination to be considered RCRA units (usually landfills). Because an AOC is equated to a RCRA land-based unit, consolidation and in situ treatment of hazardous waste within the AOC does not create a new point of hazardous waste generation for the purposes of RCRA. This RCRA AOC policy is also applicable to Superfund sites and is referred to as the Superfund AOC policy or Superfund AOC rules in this report. This interpretation allows wastes to be consolidated or treated in situ within an AOC without triggering LDR or minimum technology requirements (MTR). (NJDEP has similar requirements under the Technical Requirements for Site Remediation (Technical Rules), New Jersey Administrative Code 7:26E.) The AOC interpretation may be applied to any hazardous remediation waste (including non-media wastes) that is in or on the land. Note that the AOC policy only covers consolidation and other in situ waste management techniques carried out within an AOC. Therefore, treatment of battery casings will not be necessary to comply with the RCRA LDR if the wastes are consolidated within an AOC.

EPA's Corrective Action Management Unit (CAMU) rule is specially intended for treatment, storage, and disposal of hazardous remediation waste. Under the CAMU rule, EPA and authorized states (e.g., New Jersey) may develop and impose site-specific design, operating, closure, and post-closure requirements for CAMUs in lieu of the MTR for land-based units. Although there is a strong preference for use of CAMUs to facilitate treatment, remediation waste placed in approved CAMUs does not have to meet LDR treatment standards. NJDEP Technical Rules also allow backfill of treated wastes that may still exceed the remediation standards or criteria.

The main differences between the CAMU rule and the AOC policy are that when a CAMU is used, waste may be treated ex situ and then placed in a CAMU; CAMUs may be located in uncontaminated areas at a facility; and wastes may be consolidated into CAMUs from areas that are not contiguously contaminated. CAMUs must be approved by EPA as an ARAR during a CERCLA cleanup using a Record of Decision.

2.2.3 PCB Management under TSCA and NJDEP Remediation Program

TSCA provides federal PCB remediation policy. The TSCA regulations dealing with the remediation of soil as "bulk remediation waste" are primarily found in 40 CFR 761.61(a–c). TSCA does not regulate PCBs at concentrations less than 1 part per million (ppm). Above 1 ppm PCBs, TSCA stipulates a range of cleanup levels based upon high and low occupancy scenarios that are identified in 40 CFR 761.61(a)4:

- High Occupancy Areas (greater than or equal to 16.8 hours per week for non-porous surfaces or greater than or equal to 6.7 hours per week for bulk remediation waste) – The cleanup level for bulk PCB remediation waste in high occupancy areas is less than or equal to 1 ppm without further conditions. High occupancy areas where bulk PCB remediation waste remains at concentrations greater than 1 and less than or equal to 10 ppm shall be covered with a cap (a minimum of 10 inches of soil).
- Low Occupancy Areas (less than 16.8 hours per week for non-porous surfaces or less than 6.7 hours per week for bulk remediation waste) – The cleanup level for bulk PCB remediation waste in low occupancy areas is less than or equal to 25 ppm unless otherwise specified. Bulk PCB remediation wastes may remain at a cleanup site at concentrations greater than 25 and less than or equal to 100 ppm if the site is covered with a cap.

NJDEP Site Remediation Program policy does not require remediation for PCBs detected below 0.2 ppm. In a non-residential or restricted use scenario, soils with PCB concentrations above 0.2 ppm require a deed notice and, when above 1 ppm, require a deed notice and cap. NJDEP policy allows for contaminants with appropriate institutional and engineering controls to be non-permanently remediated if the remedy is found to be protective of human health and the environment. However, NJDEP does not routinely allow capping for the remediation of the IGW pathway.

PCB remediation wastes must be disposed of using one (or a combination, if appropriate) of the approved disposal options. Non-liquid cleanup waste (e.g., non-liquid cleaning materials, personal equipment) at any concentration and bulk PCB remediation wastes at concentrations of less than 50 ppm may be disposed of at an approved PCB disposal facility; or when disposed pursuant to Section 761 .61(a) or (c), a permitted municipal solid waste or non-municipal non-hazardous waste facility; or a RCRA Section 3004 or Section 3006 permitted hazardous waste landfill. Bulk PCB remediation waste at concentrations of 50 ppm or greater must be disposed of in a RCRA Section 3004 or 3006 permitted hazardous waste landfill or an approved PCB disposal facility (e.g., incinerator, chemical waste landfill) via an approved alternate disposal method (EPA 2005).

PCBs alone are not considered hazardous under RCRA since they are addressed under the TSCA regulations; however, land disposal restrictions do address PCBs when mixed with a waste that is considered hazardous under RCRA, such as lead-contaminated soil that exceeds TCLP limit for lead. The treatment and disposal requirements for hazardous waste are discussed under Section 2.2.2. For this site, TCLP data are not available. The TCLP criterion for lead is 5 mg/L. Using the 20 times rule, the soil lead concentration that may fail TCLP would be 100 mg/kg. Therefore, some lead-contaminated soil with PCBs may be considered characteristic waste.

2.3 Preliminary Remediation Goals

To meet the RAOs defined in Section 2.1.3, PRGs were developed to aid in defining the extent of contaminated media requiring remedial action and developing cost estimates in the FS. PRGs are chemical-specific remediation goals for each medium and/or exposure route that are expected to be protective of human health and the environment. They have been derived based on ARARs, risk-based levels (human health and ecological), and background concentrations, with consideration also given to other factors such as analytical detection limits, guidance values, and other pertinent information.

2.3.1 Preliminary Remediation Goals for Source Materials

For this site, the battery casings exhibit elevated concentrations of lead and are characteristically hazardous (D-008 for lead). Collectively, battery casings mixed with municipal waste, soil, and sediment are considered source materials because these materials serve as a continued source of contamination to soil, sediment, and potentially groundwater through wind entrainment, stormwater runoff, inundating tidal water, and infiltration from precipitation. Therefore, these source materials are considered principal threat waste and will be remediated (stabilized and contained on-site or removed from the site).

2.3.2 Preliminary Remediation Goals for Soil

Both the regulatory requirements and risk-based values were considered in the development of the PRGs for soil. Site background metal concentrations were also taken into consideration. Both federal and state chemical-specific ARARs were identified. New Jersey State NRDCSRS and TSCA are considered applicable requirements for the scrapyard area of Matteo property and the Mira Trucking property since the Matteo property and Mira Trucking are zoned as commercial (non-residential). The open field/ waste disposal area is zoned vacant/residential; however, its location within the 100-year floodplain and adjacent to a commercial scrapyard inhibits any residential construction in the foreseeable future. Therefore, the NJDEP NRDCSRS are considered applicable requirements for the open field/waste disposal area.

The current New Jersey State RDCSRS are considered applicable requirements for the Willow Woods property and the rental home area, which are zoned as residential. However, recent toxicological studies suggest that adverse health effects are associated with blood lead levels less than 10 micrograms per deciliter in children (EPA 2016). To form a remedial strategy comprising both the applicable state requirement and recent toxicological findings, a tiered approach is used to evaluate the potential extent of lead-contaminated soil requiring remedial action. Specifically, individual detections of lead exceeding 400 mg/kg in surface soils are evaluated as an initial PRG for residential properties. Subsequently, the average lead concentration within the top 2 feet across the residential property, calculated consistent with OSWER 9200.1-78, must be at or below 200 mg/kg once the selected remedial action targeting areas with concentrations greater than 400 mg/kg is complete. There is one area on the rental home property that had lead concentrations exceeding the NJDEP RDCSRS of 400 mg/kg. In the rental home area, lead concentrations below 400 mg/kg ranged from 64.5 to 371 mg/kg.

New Jersey State IGW values are TBC requirements. Based on the vertical profile of metal contamination, limited lead detections from groundwater monitoring wells, and limited lead detections in groundwater screening points, it does not appear that soils contaminated with lead outside the battery casing disposal areas act as sources that would impact groundwater quality. Even within the battery casing disposal areas, leaching of lead into groundwater has significantly decreased over time. Therefore, developing a PRG for IGW is not considered necessary under current site conditions.

Based on the HHRA, lead and Aroclor 1260 are the only site-related soil contaminants that pose unacceptable human health risks. However, site-related contaminants lead, zinc, and PCBs pose ecological risks based on the Step3a food chain models. PCBs were detected infrequently in the biota sampling, suggesting minimal risk. Therefore, ecological risk-based PRGs were developed for lead and zinc in soil for the open field/waste disposal area of the Matteo property. Moreover, the ecological risk-based PRGs developed for lead and zinc in Step 3A ecological risk assessment are lower than the background values for the site; therefore, the background values for lead and zinc, 128 and 106 mg/kg, respectively, are selected as the PRGs for surface soil (0 to 1 feet bgs) for the open field/waste disposal area.

Overall, the TSCA and NJDEP NRDCSRS and RDCSRS are applicable requirements and selected as the PRGs for the Matteo site for areas zoned commercial and residential, respectively. For areas in which ecological receptors are present, a second PRG was selected for the top 1 foot of soil based on the Step 3A food chain modeling. The PRGs for soils are presented in Table 2-4a. A figure presenting which PRGs would be applied to each area of the site is presented in Figure 2-1.

2.3.3 Preliminary Remediation Goals for Groundwater

NJDEP Groundwater Quality Standards (GWQS) are chemical-specific ARARs. Groundwater at the site is classified as Class IIA, suitable for drinking water use. Even through the groundwater is not currently utilized as a source of potable water, there are two wells on-site: one in the scrapyard area and one in the rental home area that could potentially be used as drinking water. There is also a nearby well located at the former Billy-O-Tire property between the Matteo property and Willow Woods. Federal and NJDEP drinking water standards are also relevant and appropriate requirements. For all site-related contaminants, NJDEP GWQS are the most stringent promulgated standards and were used to develop the PRGs. Since NJDEP GWQS were developed with consideration for human health risks, site-specific risk-based criteria were not developed. The PRGs for groundwater are presented in Table 2-4b.

2.4 Identification of Areas that Require Remediation

Soil contaminated at levels above the PRGs were identified based on data collected during the RIs conducted by EPA and NJDEP. The estimated remediation volumes are provided in Table 2-5. In addition, whether the general waste would require remediation is also discussed in this section.

2.4.1 Source Materials (Battery Casings Mixed with Municipal Waste, Soil, and Sediment at the Matteo Property)

During the NJDEP RI, test pits were dug to delineate the extent of the battery casings and municipal waste mixed with battery casing at the site. Figures showing the lateral and vertical extents of these disposal areas are included in Appendix B. The estimated total in-place volume of battery casings and municipal waste mixed with battery casings is 38,500 CY as shown in Table 2-5. NJDEP RI data also indicated that the first foot of soil right below the battery casings and waste contains high lead concentrations (Louis Berger 2004), most likely from the lead and acid leaked out of the battery casings. This highly contaminated soil right below battery casings is also considered as source material. The total volume of 1 foot of soil below the battery casings and battery casings mixed with municipal waste and soil is estimated to be 9,100 CY as shown in Table 2-5.

Battery casings are also scattered in sediment along the southern shore of Hessian Run immediately adjacent to the battery casing disposal areas shown in Figure 2-2. The battery casings mixed with sediment are exposed to tidal influence, are inundated daily, and could serve as a source of contamination for other sediment in the mud flat and the restored shoreline after completion of the remediation in soils, if not removed. The estimated total volume of battery casings mixed with sediments is 8,600 CY as shown in Table 2-5. Based on available data, the majority lead concentrations in sediment outside the area shown in Figure 2-2 were less than 250 ppm, and lead concentrations at select locations were between 250 and 400 ppm (see Figure 4-7 in Appendix A).

In accordance with the NJDEP Coastal Zone Management Rules, 7:7E-4.10 (i), for unauthorized filling that took place prior to September 26, 1980, removal is required only if the fill has resulted in ongoing significant adverse environmental impacts and its removal will alleviate the adverse impacts. Since the battery casings, battery casings mixed with general waste, and battery casings mixed with sediment have acted as the sources of contaminated soil and groundwater and pose unacceptable risks, these materials should be removed.

2.4.2 Contaminated Soils in the Open Field/Waste Disposal Area

Soils in the open field/waste disposal area are contaminated with lead and/or PCBs. Areas with soil contamination shallower than 2 feet bgs are designated as contaminated surface areas (Figures 2-3a and 2-5a). Areas with contamination deeper than 2 feet bgs are designated as contaminated subsurface areas (Figures 2-4a and 2-6). The test pit samples located in the battery casings areas are included in Figures 2-3a and 2-4a since they would be removed as part of a source material remediation.

Lead contamination above the non-residential PRG of 800 mg/kg was only detected in surface soil samples (less than 2 feet bgs) at a few isolated locations outside the areas with battery casings and waste mixed with battery casings (Figure 2-3a) and at three locations deeper than 2 feet bgs (Figure 2-4a). Lead contamination above the ecological PRG for the top one foot of soil of 128 mg/kg was detected in several locations throughout the open field/waste disposal area. The RI focused on delineating areas of lead concentrations greater than 400 mg/kg; therefore, the areas of surface soil with concentrations greater than 128 mg/kg but less than 400 mg/kg are shown to the extent possible based on the RI data. The estimated total volume of the soil contamination above the NRDCSRS is approximately 7,060 CY, and the estimated total volume of soil contamination above the ecological-based PRG is approximately 9,200 CY as shown in Table 2-5.

The majority of areas of PCB contamination above the PRG of 1,000 μg/kg were detected at depths shallower than 4 feet bgs (Figure 2-5a). Sample locations with PCBs exceeding the screening criteria deeper than 4 feet bgs are limited (Figure 2-6). For a majority of the area of PCB contamination, the soils also contain lead contamination. The estimated volume of PCB-contaminated soils not also contaminated with lead is 7,000 CY as provided in Table 2-5.

2.4.3 Contaminated Soils in the Scrapyard Area

In the scrapyard area, lead exceedances of PRGs were generally from 0 to 2 feet, with two locations extended to 4 feet (Figures 2-3a and 2-5a). Groundwater samples at the scrapyard area did not exceed the lead criterion, indicating that lead has not impacted the groundwater at this area.

In the scrapyard area, like the open field/waste disposal area, PCB exceedances were identified as deep as 4 feet bgs (Figures 2-4a and 2-6), except at one location between 8 to 12 feet bgs (RI Figure 4-6 in Appendix A). Since PCBs strongly adsorb to soil and would not impact groundwater, this isolated location with a PCB exceedance deeper than 8 feet was not included in the volume of soil that will require remediation. It is worth noting that the total PCB concentrations at one location, SB-107, exceeded the 50 mg/kg criteria and is therefore considered TSCA waste.

The total estimated volume of contaminated soils in the scrapyard area is 14,800 CY as provided in Table 2-5.

2.4.4 Contaminated Soil at Rental Home Area

All surface soil at the rental home area will be targeted for remediation based on an area with a lead concentration greater than 400 mg/kg and the remainder of the property having an average lead concentration greater than 200 mg/kg. The total estimated volume of contaminated soils in the rental home area is approximately 1,500 CY as provided in Table 2-5.

2.4.5 Contaminated Soil at Willow Woods Property

A removal action was performed at Willow Woods. At the time of the removal action, an area below one rental trailer could not be accessed due to a cinder block foundation and the contaminated soil was capped in place with 4 inches of concrete. This soil was capped for several reasons, including that the removal of the cinder block foundation would jeopardize the stability of the trailer and relocation of the trailer was not feasible due to zoning and permitting restraints. There is no current or anticipated future exposure to the contaminated soil due to the capping action completed. As such, no additional excavation below the trailer is recommended.

2.4.6 Source Materials (Battery Casings) and Contaminated Soil at Mira Trucking

Battery casings and contaminated soils were identified on the Mira Trucking property as described in the Matteo OU1 RI addendum (CDM Smith 2019). Areas targeted for excavation were those areas with battery casings and contaminated soil lead concentrations above the NRDCSRS of 800 mg/kg for the Mira Trucking property (Figure 2-3b). Concentrations of lead extended to 800 mg/kg to 4 feet bgs on the Mira Trucking property (Figure 2-4b). Areas targeted for excavation on the residential property P002 include areas with concentrations of lead above the RDCSRS of 400 mg/kg (Figure 2-3b). Concentrations of PCBs were also detected on the Mira

Trucking property above the NRDCSRS of 1 mg/kg; however, these areas are colocated with the areas with elevated lead concentrations (Figure 2-5b). The total estimated volume of contaminated source materials and soils on the Mira Trucking property and adjacent residential property P002 is 11,200 CY as provided in Table 2-5.

2.5 General Response Actions

GRAs are broad remedial actions that may satisfy the RAOs and characterize the range of remedial responses appropriate for the media of concern at the site. Following the development of GRAs, one or more remedial technologies and process options are identified for each GRA category. Although an individual response action may alone be capable of satisfying the RAOs, combinations of GRAs are usually required to adequately address site contamination. The following sections present the GRAs that may be applicable to each contaminated medium at the site and detail the subsequent technology screening process. The technologies and process options remaining after screening were assembled into the alternatives that are discussed in Section 3.

2.5.1 No Action

The NCP and CERCLA require the evaluation of a No Action alternative as a basis for comparison with other remedial alternatives. Under the No Action response, no remedial actions are implemented, the current status of the site remains unchanged, and no action would be taken to reduce the potential for exposure to contamination. While the No Action response may include environmental monitoring to track the contamination, it does not include any actions (e.g., institutional controls) to protect human health or the environment.

2.5.2 Institutional/Engineering Controls

Institutional controls typically are restrictions placed to minimize future use of the site (e.g., deed notices for groundwater use restrictions and/or land use restrictions and public education). Engineering controls are restrictions placed to minimize access (e.g., fencing) or other measures to reduce exposure (e.g., alternate drinking water sources). These limited measures are implemented to provide some protection of human health and the environment from exposure to site contaminants. Institutional/Engineering controls are generally used in conjunction with other remedial technologies; alone, they are not effective in preventing contaminant migration or reducing contamination.

2.5.3 Monitoring

Monitoring activities include activities such as sampling and analysis in order to track the fate and transport of the contaminants (e.g., long-term monitoring) and inspections performed to assess the risks of exposure. These measures do not decrease the T/M/V of contaminants but do assist in delineating the nature and extent of contamination over time. Hence, they are generally used in conjunction with other remedial technologies and are not effective alone in achieving the PRGs for the contaminants.

2.5.4 Monitored Natural Attenuation/Monitored Natural Recovery

Monitored natural attenuation (MNA) is a response action by which the volume and toxicity of contaminants are reduced through naturally occurring processes. MNA is usually used for contaminated groundwater and soil. Extensive modeling and monitoring are performed as part of the MNA response action to demonstrate that contaminants do not represent a significant risk and that attenuation is occurring in a timely manner. In general, processes that reduce contamination levels include dilution, dispersion, volatilization, adsorption, biodegradation, and chemical reactions with other subsurface constituents.

Monitored natural recovery (MNR) is a response action by which the risk due to existing contamination in sediments is reduced over time either through natural burial due to sedimentation of uncontaminated or less-contaminated solids or through geochemical reactions that stabilize the contaminants and reduce their bioavailability. MNR also requires extensive site characterization and long-term monitoring. The rate of recovery must be protective of human health and the environment.

2.5.5 Containment

Containment actions use physical or low-permeability barriers to minimize or eliminate contaminant migration and eliminate the exposure pathways to human receptors and the ecologic system. These measures are typically used at the source of contamination.

Containment technologies do not involve treatment to reduce the toxicity or volume of contaminants. Response actions require long-term monitoring to determine whether containment technologies are performing successfully. The NCP prefers treatment over containment since treatment provides a permanent remedy. Hence, this GRA is typically combined with other response actions.

2.5.6 Removal

Removal response actions are methods typically used to excavate/dredge contaminated soil, sediment, and waste. Excavation and dredging technologies provide no treatment but may be used prior to treatment and/or disposal response actions to remove wastes from designated areas. These methods merely transfer the contaminants to be managed under another response action.

2.5.7 Treatment

Treatment involves the destruction of contaminants in the affected media, transfer of contaminants from one medium to another, or transformation of the contaminants to a less mobile form, resulting in the reduction of the T/M/V of the contaminants and achieving a higher degree of protection of human health and the environment. Treatment technologies vary among environmental media and contaminants and may consist of chemical, physical, thermal, and/or biological processes. Treatment can be implemented either in situ or ex situ. This GRA is usually preferred unless site- or contaminant-specific characteristics make it technically infeasible or cost prohibitive. The use of treatment technologies to achieve RAOs is favored by CERCLA.

2.5.8 Disposal

Disposal response actions involve the transfer of excavated soil, sediments, source materials and/or other materials to an off-site facility permitted for the specific waste type(s) or consolidation of the excavated materials on-site in accordance with RCRA and state regulations.

2.6 Identification and Screening of Remedial Technologies and Process Options

For each GRA, technologies and process options potentially capable of addressing site contamination are identified and screened in this section. Representative remedial technologies and process options that are retained are used to develop remedial action alternatives in Section 3, either alone or in combination with other technologies. Table 2-6 summarizes the technology screening.

The technology screening approach is based on the procedures outlined in the Interim Final *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988). This evaluation process uses three criteria: effectiveness, implementability, and relative cost. Among these three, the effectiveness criterion outweighs the implementability and relative cost criteria. These criteria are described below.

Effectiveness: This evaluation criterion focuses on the effectiveness of process options to reduce the T/M/V of contamination for long-term protection and to meet the RAOs and PRGs. It also evaluates the potential impacts to human health and the environment during construction and implementation and how proven and reliable the process is with respect to site-specific conditions. Technologies and process options that are not effective are eliminated using this criterion.

Implementability: This evaluation criterion encompasses both the technical and administrative feasibility of the technology or process option. It includes an evaluation of pretreatment requirements, remedial construction requirements, residuals management, the relative ease or difficulty of operation and maintenance (O&M), and the availability of qualified vendors. Technologies and process options that are clearly not implementable at the site are eliminated using this criterion.

Relative Cost: Cost plays a limited role in the screening process. Both capital and O&M costs are considered. The cost analysis is based on engineering judgment, and each process is evaluated as to whether costs are low, medium, or high relative to the other options within the same GRA category.

2.6.1 No Action

The No Action alternative is not a technology. The NCP requires that a No Action alternative be considered as a basis for comparison.

Effectiveness: The No Action alternative is used as a baseline against which other technologies may be compared. It generally does not provide measures that would comply with the ARARs or otherwise meet the RAOs. This alternative has been retained as required by the NCP.

Implementability: The No Action alternative is implementable given that no action would be required.

Relative Cost: The No Action alternative involves no capital, O&M, or administrative cost.

Conclusion: The NCP requires that the No Action alternative be retained for further consideration.

2.6.2 Institutional/Engineering Controls

2.6.2.1 Deed Notice

A deed notice is a regulatory action used to prevent certain types of land use where direct exposure to contaminated soil (via dermal contact or ingestion) or inhalation of contaminants associated with the dust represents an unacceptable human health risk. A deed notice may be used to prevent subsurface intrusive activities (i.e., digging in soil during construction).

Effectiveness: Institutional controls alone would not reduce the T/M/V of contaminants and would not reduce site-related contaminant concentrations to protective levels. These controls alone would not be protective of human health since surface soil contamination exists at concentrations greater than the PRGs. The Matteo property is zoned as commercial, and a deed notice may be implemented to keep this designation in the future. The effectiveness of institutional controls depends on the reliability of their execution, which is most likely controlled by the local government.

If capping is selected as a remedy, contaminants with concentrations greater than the PRGs would be left in place. A deed notice could then be effective to prevent intrusive activities that may result in direct contact with contamination at concentrations that pose risks to human health.

Implementability: A deed notice would limit future land use options and may be implemented in addition to remediation activities as a protective measure to prevent exposure to site contaminants. A deed notice may be difficult to enforce if the local government has limited resources and may face resistance from property owners if they have a negative impact on property values.

Relative Cost: The implementation cost is low.

Conclusion: A deed notice will be retained for further consideration.

2.6.2.2 Fencing and Warning Signs

Fencing would reduce human contact with the contaminated soil and sediment by limiting access to contaminated areas. Warning signs are usually used in conjunction with fencing to indicate the hazards present at the site and to warn trespassers. Warning signs posted to warn of unsafe consumption of fish as harmful can deter fishing activities at the site. Fencing has been installed between the Matteo property, the Willow Woods property, and the rental home area. Signs have been installed in Hessian Run to warn of the contamination in the sediment and potentially in fish.

Effectiveness: Fencing and warning signs can be effective in reducing human exposure to contaminated soil and sediment but do not reduce the T/M/V of the contamination, which would continue to pose risks to human health and the environment. These controls would not reduce contaminant concentrations to protective levels. Fencing and warning signs are not effective alone but can be used in conjunction with other remedial technologies.

Implementability: This process option would be easily implementable for the site since equipment for this process option is readily available.

Relative Cost: Fencing and warning signs have low capital and O&M costs.

Conclusion: Fencing and warning signs will be retained for further consideration.

2.6.2.3 Community Awareness

Community awareness involves informational and educational programs to enhance awareness of potential hazards, available technologies that can address the contamination, and the remediation progress in the local community.

Effectiveness: Increasing awareness in the local community of site-related contamination will help to protect human health and may enhance the implementability of deed notice. However, these programs alone would not reduce site contaminant concentrations to protective levels.

Implementability: This option would be implementable.

Relative Cost: This option has low capital and O&M costs.

Conclusion: Community awareness will be retained for further consideration.

2.6.2.4 Inspection and Maintenance Program

An inspection and maintenance program would include inspection of engineering control systems and performance of repairs, as necessary. If capping of contaminated soil on-site (such as in the open field/waste disposal area) and/or in situ capping of contaminated sediment are selected as part of the remedy, periodic inspection of the integrity of the cap(s) would also be necessary.

Effectiveness: Inspection and maintenance alone would not be effective in reducing contamination levels and would not reduce the risk to human health or the environment. Inspection and maintenance can be effective when combined with other remedial technologies such as capping and institutional controls to provide protection of human health and the environment. Data collected as part of an inspection and maintenance program would be used to evaluate the effectiveness of active remedial action measures and to provide information to decision makers.

Implementability: Inspection and maintenance are proven technologies and controls and can be easily implemented.

Relative Cost: This option has low capital and medium O&M costs.

Conclusion: Inspection and maintenance will be retained for further consideration.

2.6.3 Long-Term Monitoring

A monitoring program includes collection of samples from contaminated media to monitor contaminant concentrations such as groundwater samples. Monitoring is a proven and reliable process for tracking the migration of contamination during and after response actions are completed. Therefore, monitoring would not be implemented as a stand-alone response action but would be used in conjunction with other proposed alternatives to evaluate and monitor the remediation progress. Monitoring activities can occur during the construction phase of work as well as part of post-construction O&M as a long-term monitoring program. Monitoring as part of a long-term monitoring program would continue until contamination is no longer present either having been treated by a remedial action or through natural attenuation.

Effectiveness: Long-term monitoring alone would not be effective in reducing contamination levels and would not reduce the risk to human health or the environment. Long-term monitoring can be effective when combined with other remedial technologies, such as capping and institutional controls, to provide protection of human health and the environment. Data collected as part of a long-term monitoring program would be used to evaluate the effectiveness of active remedial action measures and to provide information to decision makers.

Implementability: Long-term monitoring is a proven technology and can be easily implemented.

Relative Cost: This option has low capital and medium O&M costs.

Conclusion: Long-term monitoring will be retained for further consideration.

2.6.4 Monitored Natural Attenuation

MNA for soil and MNR for sediment are evaluated in this section.

2.6.4.1 Monitored Natural Attenuation

MNA relies on naturally occurring attenuation processes to achieve site-specific remediation goals within a reasonable time frame. Natural attenuation processes that reduce contaminant concentrations in soil include destructive mechanisms (biodegradation and oxidation/reduction reactions) and nondestructive mechanisms (precipitation, dissolution, adsorption, and desorption).

Site-related inorganic contaminants antimony and zinc were found in the uppermost 4 feet of soil and lead in the uppermost 8 feet of soil. There is a clear decrease in metal concentrations with depth (CDM Smith 2018a). Lead is the primary contaminant associated with handling and disposal of lead-acid batteries. In a lead-acid battery, lead is present as lead oxide, elemental lead, lead sulfate, and lead II ion in a dilute sulfuric acid solution. When the batteries were crushed, the acid was released to the soil and neutralized by soil over depth. Lead II, the most mobile form of lead, would have precipitated as lead sulfate, lead carbonate, or lead phosphate or otherwise sorbed onto soil organic matter, reducing its mobility. The average soil pH was found to be 6.4 in the scrapyard area and 5.8 in the open field/waste disposal area. These pH levels are slightly acidic but not favorable for leaching metals to groundwater. Comparison of total and dissolved metal results (for seep samples and porewater samples) indicates that lead may have been transported from the battery casing disposal areas to sediment and surface water as colloids. The sediments in the mudflats of Hessian Run contain high organic material. Metals would sorb with organic materials in sediment and exhibit limited mobility.

PCBs are stable compounds. They strongly sorb to the organic constituents of soil and sediment and tend to leach at low concentrations and rates, and so typically do not impact groundwater.

Even though the site-related inorganic contaminants are considered essentially immobile, they can still be toxic to human and ecological receptors through ingestion, dermal contact, and inhalation. Therefore, the surface soil contamination and shallow sediment contamination could still pose risks to human and ecological receptors.

Effectiveness: MNA is an effective remediation approach for sites where the natural soil and sediment retention capacity could immobilize the contaminants and also reduce the bioavailability of contaminants. At this site, data from the NJDEP RI (Louis Berger 2004) and the EPA RI (CDM Smith 2018a) indicate that the inorganic contaminants and PCBs are not mobile in soil and sediment but lead most likely is still being transported from the battery casing disposal areas to the sediment as colloids. There is no evidence that MNA will be effective in reducing the toxicities of site-related contaminants. Therefore, MNA may have reduced the impact to groundwater but not toxicity.

Implementability: MNA is implementable. Materials and services necessary to monitor the dynamics of contaminant migration and transformation are readily available. Long-term monitoring would be required as a control measure for MNA.

Relative Cost: MNA involves moderate O&M costs from long-term monitoring, including sample collection, analysis, and reporting.

Conclusion: MNA will not be retained for further consideration due to the concerns regarding its effectiveness for direct exposure pathways such as direct contact, ingestion, and inhalation.

2.6.5 Containment

Containment technologies are implemented to reduce contaminant mobility in terms of leaching to groundwater and to reduce or eliminate exposure of human and ecological receptors. These technologies do not directly impact contaminant toxicity or volume. Containment technologies are typically accompanied by long-term monitoring in the vicinity of containment to verify that the containment measures continue to be effective. The commonly used containment technologies include capping, slurry walls, and engineered barriers. Slurry walls are used to contain contamination below the water table. Since most of the contamination at the Matteo site exists between the water table and the ground surface, slurry walls are not discussed.

2.6.5.1 Engineered Containment Structure

An engineered containment structure would be constructed on-site to isolate and contain the contaminated materials. This structure would generally consist of bottom liners, sidewalls, and a low-permeability cover to prevent direct contact by receptors, infiltration of precipitation and surface runoff, and leaching of contamination into the groundwater. Implementation of this technology depends on the availability of suitable land space and regulatory approval.

Effectiveness: The engineered structure would be effective in preventing direct contact with source materials (crushed battery casings and battery casings mixed with waste and sediment) and contaminated soil. The containment structure would need to be constructed with a low-permeability barrier at the bottom, a leachate collection system, and an impermeable top liner to prevent infiltration and potential leaching of contaminants into groundwater. A long-term maintenance and monitoring program would be required to ensure that the structure is functioning effectively.

Implementability: This process option is technically implementable. The materials, experienced vendors, and equipment are readily available. However, most of the Matteo property is either within the 100-year flood zone or in use as a recycling facility. Depending on the volume of source materials and contaminated soil, there may not be a large enough area above the 100-year flood zone to accommodate the containment cell. Installing a containment cell within the 100-year flood zone would require NJDEP's approval, and the cell would need to be designed to ensure that the contaminants would not be released or pose risks to human and ecological receptors in case of flooding.

Relative Cost: This option involves moderate to high capital costs and low to medium O&M costs.

Conclusion: The engineered containment structure will be retained for further consideration.

2.6.5.2 Capping/Covering of Soil

This process option is for isolating contaminated soil left in place. There are two basic cap designs: multi-layered and single-layered caps. Multi-layered caps are mostly used for covering RCRA hazardous wastes that may leach contaminants to groundwater. Single-layered caps are used most commonly to prevent direct contact risks.

Effectiveness: Installation of a cap would be effective in preventing direct contact with contaminated soil. Properly designed and installed caps could also prevent infiltration and potential leaching of contaminants to groundwater; however, to date, there is no evidence that contaminated soil outside the battery casing disposal areas has leached to groundwater. Capping would significantly limit land reuse, and long-term inspection and maintenance of the cap would be required.

Implementability: The cap would be installed using conventional earth-moving construction equipment. Installing a single-layered cap in the scrapyard area (e.g., using asphalt) would be implementable. Installing a single-layered cap in the open field/waste disposal area within the 100-year flood zone would require soil erosion control measures to ensure the integrity of the cap as designed. Capping would limit future land use and require a rigorous inspection and maintenance program to ensure site contaminants would not become exposed and would not migrate to the groundwater. Capping as a remedy generally requires a deed notice to be filed with NJDEP for approval.

Relative Cost: Capping involves moderate capital and O&M costs based on the relatively large area required to be covered.

Conclusion: Capping will be retained for further consideration.

2.6.6 Removal

Removal response actions are methods typically used to excavate and handle contaminated materials. Removal technologies provide no treatment of wastes but are used prior to treatment and/or disposal to remove wastes from designated areas.

2.6.6.1 Excavation

Excavation technologies use standard earthwork equipment (e.g., backhoes, bulldozers, front-end loaders, and long-arm excavators) to excavate contaminated materials for consolidation, treatment, and/or disposal. For this site, these contaminated materials include source materials (battery casings, battery casings mixed with waste, and battery casings mixed with sediments) and soils. Manual excavation is useful for removal of small amounts of soil when heavy machinery cannot be used in certain areas that are hard to access or where utilities are buried.

Effectiveness: Excavation is effective in removing contaminated materials where equipment can access the contaminated materials and has space to maneuver. Depending on the extent of excavation, it could completely remove the contamination exceeding the PRGs or leave some residual contamination. However, excavation alone would not reduce the T/M/V of the contaminants. Excavation is a common construction technique and does not require long-term maintenance or monitoring. For the battery casing disposal areas, a standard excavator and a long-arm excavator would be effective in removing the contaminated materials.

Implementability: Excavation is technically and administratively feasible for this site. The process uses commercially available equipment. The thickness of crushed battery casings at the battery casing disposal areas varies from 6 to 8 feet. Excavation in this area may require cut backs or benching for soil stability. Since excavation would be performed within wetlands and the 100-year flood zone, a waterfront development permit equivalency would be required, and the method for restoring the shoreline and wetlands would need approval by NJDEP during the remedial design phase.

Relative Cost: Excavation has high capital costs but no O&M costs.

Conclusion: Excavation will be retained for further consideration.

2.6.6.2 Dredging

Dredging removes contaminated sediments (mixed with battery casings) for consolidation, treatment, and/or disposal. There are two types of dredging technologies: mechanical and hydraulic. Mechanical dredging uses mechanical means such as a clamshell bucket or a barge-mounted excavator. Hydraulic dredging uses suction pumps or other types of pumps in conjunction with a cutter head to remove sediment hydraulically. Mechanical and hydraulic dredging require different management approaches; are affected by site conditions such as size and amount of debris and land available for sediment dewatering and handling; and may result in different levels of residuals, re-suspension, and release of contaminated sediments.

Effectiveness: Dredging is effective in removing contaminated sediments from designated areas. However, dredging alone would not reduce the T/M/V of the contaminated sediments. Dredging also temporarily causes significant adverse effects to the benthic ecosystem in the vicinity of dredging. Both mechanical and hydraulic dredging could be effective at the site if a cofferdam or similar structure is installed at the confluence of Hessian Run and Woodbury Creek to maintain a sufficient water level in Hessian Run for dredge operations (estimated at 3 feet or more). Without damming the water, it would be extremely inefficient to conduct waterside dredging only during high tide. Furthermore, residual contamination may need to be sampled and evaluated following dredging activities, and overdredging may be needed to ensure all source materials have been removed.

Implementability: Dredging is technically implementable. Like excavation, equipment for environmental dredging and experienced vendors are commercially available. Since dredging would be performed within an intertidal wetland, a waterfront development permit equivalency would be required. The dredging plan would also need to be reviewed and approved by the NJDEP Site Remediation Program Office of Dredging and Sediment Technology during the remedial design phase. The method for restoring the dredged areas and the wetlands would be subject to NJDEP approval during the remedial design phase. At this site, the Hessian Run consists of mainly mudflat. The available time to conduct dredging with at least 4 feet of water present will be limited.

Relative Cost: Dredging has high capital costs and no O&M costs.

Conclusion: Dredging is not retained for further consideration since battery casings mixed with sediments are only along the shoreline. Removal of these materials can be achieved more efficiently using an excavator from land.

2.6.6.3 Dewatering

Removal of materials below the water table would require the use of ancillary technologies to dewater the materials. Ancillary technologies are not stand-alone technologies that can help achieve the RAOs but are used in conjunction with a primary technology or a process option that helps meet the RAOs. Because hydraulically dredged sediment is pumped as a sediment/water slurry, the dewatering of hydraulically dredged sediments would require specialized equipment such as a filter press. Mechanically dredged sediments and wet excavated materials may be dewatered passively, mechanically, and/or through application of a drying agent. Dewatering should be combined with treatment technologies to treat the water that is generated from the process prior to discharge.

Effectiveness: Dewatering is effective in removal of excess water from the sediment. The technology selected would depend on the dredging technology and sediment disposal approach selected. A combination of process options may be utilized to achieve the best results.

Implementability: Dewatering is technically implementable. It may require a large land area if it is conducted passively by natural evaporation and drainage of excess water. Water generated during the dewatering process must be managed appropriately and would likely require treatment prior to discharge back to surface water.

Relative Cost: Dewatering of mechanically dredged sediments and excavated wet materials has low to high capital and O&M costs. The construction of a specialized facility to dewater hydraulically dredged sediments may increase capital costs.

Conclusion: Dewatering will be retained for further consideration in conjunction with removal of materials below the water table.

2.6.7 Treatment

Solidification/Stabilization (S/S) technologies prevent migration of and exposure to contaminants by binding a contaminated medium with a reagent to change its physical properties (solidification) and/or initiating a chemical reaction to reduce the leachability of a waste (stabilization). EPA has identified S/S treatment as the best demonstrated available treatment technology for at least 50 RCRA hazardous wastes. Many reagents are available for S/S. Organic binders include asphalt, organophilic clay, activated carbon, epoxide, polyesters, and polyethylene. Inorganic binders include cement, fly ash, lime, phosphate, kiln dust, soluble silicates, and sulfur-based binders. Many proprietary additives are also readily available. A treatability study is usually conducted to customize the reagent mixture to achieve the designed physical characteristics of the waste material and to meet LDR treatment requirements. The treated media can often be reused on-site for redevelopment. For PCBs, limited data are available regarding the long-term stability of wastes treated using S/S technologies. Therefore, a long-term monitoring program would be implemented to verify continuing effectiveness over time.

Projects utilizing S/S technologies fall into four categories: in situ S/S, ex situ S/S, in situ stabilization only, and ex situ stabilization only. Vitrification, by which extremely high temperatures are applied to waste media (either in situ or ex situ) in order to immobilize inorganics and destroy organic pollutants, is one form of S/S treatment that was not evaluated in this feasibility study due to the small number of case studies available, the high energy requirements, and high costs that generally preclude it from being an option.

2.6.7.1 In Situ Stabilization

In situ stabilization, also referred to as in situ geochemical fixation, would involve direct application of a reagent or reagents to chemically or biologically alter the contaminants to reduce their mobility without significantly changing the physical state of the waste. Phosphates alone are effective in stabilizing lead, and the resulting products exhibit low solubility over a wide pH range. Application of phosphates, such as apatite, to lead-contaminated media sequesters the lead as pyromorphite, the most stable mineral form of lead. In situ and laboratory tests have shown that phosphates can also immobilize other potentially toxic metals, including zinc. In comparison with other technologies, phosphate-based stabilization is relatively low cost and easy to apply. Many proprietary additives are commercially available such as Apatite II, a technology for phosphate immobilization using fish bones. Other sources of phosphates for lead remediation include mineral apatite, rock phosphate, soluble phosphate fertilizers, and biosolids compost from treated sewage. Benefits of fish bones are that they are free of contaminants, avoid ecological issues associated with mining phosphates, and will not dissolve. Other common additives to control speciation are sulfides, carbonates, and silicates. Various co-precipitation reactions are utilized where re-speciation is not effective, and sorbents, ion exchangers, passivators, and complexing agents may also be used.

Less information is available on in situ stabilization of organics such as PCBs. Nonetheless, there has been demonstrated effective use of organic additives, such as activated carbon, to sequester PCBs.

Effectiveness: For contaminated soil, the effectiveness of in situ stabilization in terms of leachability would depend on how well the reagent(s) can be mixed with the subsurface soils.

Uniform mixing of contaminated soils with the reagent(s) is critical and would be more difficult to attain in situ than ex situ. Finding the right blend of additives that would successfully sequester both PCBs and metals in the contaminated media is also critical. A treatability study would be necessary to identify a feasible design mixture.

Furthermore, in situ stabilization would not reduce the toxicity and bioavailability of treated metals or PCBs in surface soil. It would need to be combined with capping technology to prevent exposure to human and ecological receptors.

Implementability: This process option is technically implementable for soil using in situ soil mixing augers or jetting equipment. A large quantity of water is generally added to facilitate the in situ mixing process.

Relative Cost: This process option has medium to high capital costs based on total project costs to develop an acceptable mix design and stabilization method and low O&M costs associated with long-term monitoring.

Conclusion: This process option is not retained for further consideration due to possible ineffectiveness in subsurface soils and potential to not achieve uniform mixing compared to ex situ stabilization.

2.6.7.2 Ex Situ Stabilization

Ex situ stabilization would involve the same processes used for in situ stabilization, but contaminated soils would be excavated, mixed with reagent(s), and subsequently either backfilled or disposed of off-site.

Effectiveness: Ex situ treatment would be more effective than in situ stabilization because it is easier to control the mixing process ex situ than in situ to achieve complete contact between the reagent(s) and the contaminants. As previously described, phosphates have been shown to effectively stabilize lead while activated carbon has been used to successfully sequester PCBs. Ex situ stabilization may also be an effective process option to treat waste prior to off-site disposal to meet the landfill requirements. Stabilized soil may not be suitable for on-site backfill in surface soil or shallow sediment because the toxicity of the stabilized soil may still pose risks to human and ecological receptors.

Implementability: This option is technically implementable with little difficulty for excavated soil. A bench-scale study would be necessary to select the reagent(s) and determine the dosage. Vendors and equipment for ex situ stabilization of metal contamination are readily available.

Relative Cost: This process option has medium to high capital costs and low O&M costs associated with long-term monitoring, which would be required only if the waste product is reused on-site.

Conclusion: This process option will be retained for further evaluation.

2.6.7.3 In Situ Solidification

This method would involve the injection of reagent(s) directly into the contaminated media to immobilize contaminants. An auger or injector head system could be used to drill into the soil and mix the reagent(s) with the media. The reagent(s) would be applied via nozzles at the bottom of the augers as they turn. Grout injection could also be utilized by which high-pressure injection pipes are forced into the soil and used to apply the reagent(s). Treated waste would be left in place, with or without capping.

Effectiveness: Lead is the most common metal contaminant treated in soil at Superfund sites utilizing solidification technologies to reduce leachability, and case studies have shown solidification to be effective in remediating lead with post-treatment metals concentrations generally meeting the RCRA TCLP standards. Cement-based in situ solidification has also been used at many sites contaminated with PCBs to reduce the mobility and leachability of PCBs. Long-term monitoring would be required to ensure the continued effectiveness of the remedy over time. A cap would need to be installed on top of solidified contaminants to eliminate the direct contact risks.

It is also important to note that some organic contaminants, inorganic salts, and metal compounds can have a detrimental effect on the setting and curing reactions of some cementitious materials and may not be immobilized by solidification treatment. In addition, very fine particles, such as those in silts and clays, can weaken the bond between cement paste and the particulates by particle coating action. A treatability study would need to be conducted to ensure the reagent(s), the ratio of reagent(s) to waste material, and any additives are properly selected for the range of site soil types.

The effectiveness of in situ solidification also depends on how well the reagent(s) can be mixed with the subsurface soil. Uniform mixing of contaminated soil with the reagent(s) is critical and would be more difficult to attain in situ than ex situ. Determining the effectiveness of in situ solidification of the source materials would require pilot testing.

Implementability: This option is technically implementable for soil. In situ solidification of contaminated soil may also not be desirable because it would limit future land use options. Additionally, in situ solidification of the source materials, which are located along the shoreline, would impact the wetland habitat along the shoreline.

Relative Cost: This process option has medium to high capital costs and low O&M costs associated with long-term monitoring.

Conclusion: This process option will not be retained for further evaluation because lead and PCBs in the soils are not leaching to groundwater.

2.6.7.4 Ex Situ Solidification

This method would involve the excavation of contaminated soils followed by machine mixing of the media with reagent(s) to solidify and stabilize the contaminants. Most Superfund sites using solidification technologies involve ex situ application of inorganic binders and additives to treat waste contaminated with metals. Processing of the contaminated media could be done in an on-site mobile unit. The waste product resulting from ex situ solidification could be a monolithic block of waste that could be either disposed of off-site or reused on-site to support redevelopment.

Effectiveness: This process option would be more effective than in situ solidification due to improved control of the mixing process ex situ. Long-term monitoring would be necessary to ensure the effectiveness of ex situ solidification over time if the waste product is reused on-site.

Implementability: This option is technically implementable for excavated soils. Vendors and equipment are readily available. A bench-scale treatability study would be necessary to select the reagent(s) and determine the dose. This technology would be implemented in combination with removal and disposal technologies.

Relative Cost: This process option has medium to high capital costs and low O&M costs associated with long-term monitoring, which would be required only if the waste product is reused on-site.

Conclusion: This process option is not retained for further consideration because a monolithic waste cannot be reused at the site.

2.6.8 Disposal

Disposal response actions for source materials and soil would involve the transport of excavated materials to an off-site facility permitted for the specific waste type or backfill on-site if treated to regulatory limits. Depending on the disposal facility, pre-treatment may be required prior to disposal.

2.6.8.1 Off-site Disposal at a Non-Hazardous Waste (RCRA Subtitle D) Landfill

This option involves disposing of non-hazardous contaminated material at an off-site non-hazardous waste (RCRA Subtitle D) disposal facility. Off-site landfills are commercially owned, permitted facilities that minimize the potential environmental impacts of waste. Landfilling is considered a non-treatment alternative and less acceptable than treatment alternatives by CERCLA. The final determination of whether the excavated material is hazardous or non-hazardous will be based on TCLP testing.

Effectiveness: Landfill disposal is effective in preventing direct contact with and reducing the mobility of contaminants. The volume and toxicity of the waste would not be reduced.

Implementability: This technology is implementable.

Relative Cost: This process option involves moderate to high capital and no O&M costs.

Conclusion: Off-site disposal at a non-hazardous waste landfill will be retained for further consideration.

2.6.8.2 Off-site Disposal at a Hazardous Waste (RCRA Subtitle C) Landfill

If any of the contaminated waste material is determined by TCLP testing to be hazardous, it must be disposed of in a RCRA Subtitle C landfill and will require treatment to meet the LDR UTS at a hazardous waste treatment facility prior to disposal.

Effectiveness: Landfill disposal is effective in preventing direct contact with and reducing the mobility of contaminants. Volume and toxicity of wastes would not be reduced unless treatment is conducted.

Implementability: This technology is implementable since RCRA Subtitle C landfills that accept metal-contaminated materials are available.

Relative Cost: This process option involves high capital and no O&M costs.

Conclusion: Off-site disposal at a hazardous waste landfill will be retained for further consideration.

2.6.8.3 TSCA Landfill

If any PCB concentrations in soils are greater than 50 mg/kg, the soils need to be disposed of at a TSCA landfill.

Effectiveness: Landfill disposal is effective in preventing direct contact with elevated PCBs. However, it does not reduce the volume and toxicity of wastes unless treatment is conducted.

Implementability: This technology is implementable as TSCA landfills that accept metal-contaminated materials are available. TSCA landfills capable of taking soils and materials with PCB concentrations greater than or equal to 50 mg/kg PCB have yearly tonnage acceptance limits. These limits are determined by the state in which they are located and are specified in the landfill's permit.

Relative Cost: This process option involves high capital costs and negligible O&M costs.

Conclusion: Off-site disposal at a TSCA landfill will be retained for further consideration.

Section 3

Development and Screening of Remedial Action Alternatives

This section describes the remedial action alternatives developed to address site contamination to meet the site-specific RAOs. Alternatives were created by combining the technologies and process options retained in Section 2.

3.1 Development of Remedial Action Alternatives

Several technologies and process options were retained for contaminated materials based on the screening in Section 2. The retained technologies and process options were combined to develop remedial action alternatives.

The retained technologies and process options are summarized below.

- No action
- Institutional and engineering controls (such as classification exception area [CEA], deed notice, fencing, long-term monitoring, inspection, and maintenance)
- Capping of soil
- On-site engineered containment structure
- Excavation
- Ex situ stabilization
- Off-site disposal

To develop remedial alternatives for the site, representative process options were selected from the same groups of remedial technologies, as appropriate. However, other process options may still be applicable and should be considered during the remedial design stage of the project. The retained technologies were combined into five alternatives for the source materials (battery casings, waste mixed with battery casings, sediment mixed with battery casings) and contaminated soils.

The five alternatives developed for the site are listed below. Table 3-1 presents a summary of the alternatives and illustrates the varying degrees of contaminated materials staying on-site or being disposed of off-site.

Alternative 1 – No Action

Alternative 2 – Excavation, Stabilization, On-site Containment, and Capping

Alternative 3 – Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping

Alternative 4 – Excavation and Off-site Disposal of Source Materials and Contaminated Soils, and Capping

Alternative 5 – Excavation and Off-site Disposal

3.1.1 Common Elements

The common elements included as part of Alternatives 2 through 5 are described here. Note that this FS describes a conceptual approach for the remedial action. Many assumptions are made for order of magnitude cost estimating purposes. The final approach for remedial action would be determined during the remedial design.

Pre-Design Investigation

During the remedial design, a pre-design investigation (PDI) would be performed to refine the vertical and horizontal extents of the areas requiring remediation, specifically to delineate the extent of surface soil (0 to 1 foot bgs) exceeding the ecologic PRGs. Borings could also be installed to the north of SB-113 to determine the boundaries of the PCB concentrations exceeding 50 and 1 mg/kg. Furthermore, soil samples could be collected at different depths below the source materials to determine and confirm the vertical extent of source materials for removal. Waste characterization sampling would also be collected to determine the appropriate disposal method(s) for materials removed from different areas of the site.

Geotechnical testing would be conducted in the Hessian Run mudflats near the battery/waste disposal area to determine engineering properties of the sediment and assess the constructability of berms, sheet piles, or a cofferdam to block tidal water during remediation. Data collection would also be conducted to support the design of shoreline restoration of Hessian Run.

A treatability study may be conducted to evaluate various commercially available lead stabilization reagents, determine the most cost-effective reagent suitable for this site, and recommend the dosage of such a reagent for use in the remedial action.

Additionally, the Phase 1A cultural resources survey recommended a Phase 1B cultural resources survey in some areas at the site that overlap with locations of remedial activities. The Phase 1B survey would be completed during the PDI. Results from the PDI would be incorporated into the remedial design and the remedial action.

Remedial Design

Based on data collected before and during the PDI, a remedial design would be conducted that would provide rationale, detailed approaches, and cost estimates for the OU1 remedial action. It should be noted that the scope of remediation of OU1 is to remove the principal threat waste (the source materials) and remediate contaminated soils. After the source materials, including the battery casings and waste mixed battery casings and sediment mixed with battery casings, are removed, the restored southern shoreline of Hessian Run would be inundated with tidal water. Since the OU1 study area does not encompass the sediments, any portion of the restored shoreline below the mean high-water elevation would be subject to re-evaluation in OU3 and the OU3 remedial goals. Therefore, during the OU1 remedial design, design of shoreline restoration would be developed with consideration to OU3. Hydraulic modeling may be conducted as necessary for shoreline restoration.

Excavation and Handling of Source Materials

The source materials along the shoreline of Hessian Run (as identified in Section 2.4.1) would be excavated. The excavation methods would be developed during the remedial design. For this FS, it is assumed that an offshore berm would be constructed on top of the mudflats along the northern edge of the sediments mixed with battery casings and a long-reach excavator would be used from the shore or the earthen berm to excavate the source materials. It is also assumed that imported clean fill (in impermeable bags) could be used to construct the berm. During the remedial design, other methods to either block tidal flow or excavate during low tide would be considered such as a Portadam or sheet piling. Approximately 3,000 feet of shoreline would require remediation. Remediation could be performed in segments or work areas. Each work area under remediation could be fully enclosed so that the excavation could be conducted without the excavated materials becoming inundated with tidewater.

After removal of source materials shown in Figure 2-2, it is assumed that the excavation would extend 1 foot beneath the source materials and 1 foot out from the sidewall if the source materials are in direct contact with the sidewall soils. The width and depths of sediment mixed with battery casings to be removed are shown in Figure 2-2. Post-excavation soil and sediment samples would be collected from the bottom and sidewalls of the excavation following the NJDEP requirements to document the remaining contaminant concentrations.

Due to the depth of source materials, the excavation would need to be operated under the water table for the last few feet before reaching the targeted depths. The need to dewater the excavation area and dewatering of excavated sediment mixed with battery casings would be evaluated during the remedial design. At the completion of excavation, imported clean fill would be used for backfilling of the excavated area in accordance with a site restoration plan. Restoration of the excavated area would need to consider future sediment remediation under OU3.

The remedial action contractor would coordinate with the utility companies, PSE&G and Colonial Oil, for the areas with utility crossings to eliminate or minimize impacts to utility services and to meet the engineering requirements for excavation of contamination next to or underneath existing utilities.

Temporary Restoration of the Shoreline of Hessian Run

Following the removal of source materials, the shoreline would be temporarily restored for erosion control. For cost estimating purposes in this FS, it is assumed that clean fill used to construct the berm and additional imported clean fill, if necessary, would be used to backfill the excavated area to provide shoreline slope stability and integrate the excavated area into the post-excavation upland and the mudflats outside the excavation area. A minimum of 1 foot of clean fill would be used to cover the excavated area. Any slope with exposed general waste would be covered with imported clean fill to a design slope for stability, then protected with erosion control measures such as erosion control blankets and vegetation. All fill materials would be analyzed to demonstrate that it meets the surface soil remediation goals. Restoration of the shoreline to current conditions would not be required since the current shoreline was created by landfilling with waste. The total volume of soil for backfill and temporary shoreline restoration would be significantly less than the excavation volume.

The temporarily restored shoreline would be inundated with tidal water and as such would be considered sediment to be evaluated in OU3. Restoration of wetlands along Hessian Run would be evaluated and developed in OU3.

Removal of Lead Contamination at Rental Home Area

All surface soil at the rental home area would be excavated to 2 feet and backfilled with clean fill. Analysis of the fill would be conducted to demonstrate that the soil meets RDCSRS and the average lead concentration is below 200 mg/kg.

Excavation and Off-site Disposal of Source Materials from Mira Trucking

The contaminated materials at Mira Trucking will be excavated and disposed of off-site as shown in Figure 3-1. The excavation will remove all battery casings present at the property and the surrounding soil with concentrations of lead above 800 mg/kg. The excavation will extend to 4 feet bgs in some areas, including around the berm and in the southern portion of Truck Staging Area 1. Contaminated soil in the northeastern corner of residential property P002 will also be excavated to 1 foot bgs. Both properties will be backfilled with clean fill and restored to pre-remediation conditions.

Institutional Controls for Groundwater

A CEA would be implemented for the perched groundwater underneath the site to prevent the use of contaminated groundwater for drinking purposes. The CEA would include site contaminants, such as lead, as well as the non-site-related contaminants, such as vinyl chloride, that were detected at the site.

Connection to City Water

Currently, the on-site residence, the former Billy-O-Tire property, and the water supply in Matteo's operation facility are not connected to city water. To ensure that the water near the site is not used for drinking purposes, these buildings would be connected to city water.

Long-Term Monitoring of Groundwater

Remediating the battery casings along the shoreline is expected to reduce site-related groundwater and surface water contamination. A monitoring program will be implemented to assess the effectiveness of removing the source materials (i.e., battery casings and contaminated soil and sediment) in reducing lead contamination. Data collected during the monitoring program will be evaluated to support a future groundwater decision document and to evaluate the impact of source removal on the groundwater concentrations. The cost estimate assumes 10 years of groundwater monitoring; it is assumed that after 10 years of monitoring, monitoring would then be implemented by a separate operable unit addressing groundwater.

Site Reviews

Five-year reviews would be conducted for Alternatives 2 through 5 as required by CERCLA. The reviews would assess any ongoing risks to human health and the environment and the effectiveness of remediation and institutional controls. The data collected during the long-term monitoring program would be used in the reviews. Based on each review, a decision would be made for future management of the site.

3.1.2 Alternative 1 – No Action

No remedial action would be implemented under this alternative. The No Action alternative was retained in accordance with the NCP to serve as a baseline for comparison with the other alternatives.

3.1.3 Alternative 2 – Excavation, Stabilization, On-site Containment, and Capping

This alternative is presented in Figure 3-2 and consists of the following components:

Prior to Remedial Action

- Pre-design investigation and remedial design as described in Section 3.1.1

Remedial Action

1. **Source Materials**
   - Excavation and handling of the source materials as described in Section 3.1.1
   - On-site containment of source materials
   - Temporary restoration of the shoreline of Hessian Run as described in Section 3.1.1
2. **Open Field/Waste Disposal Area**
   - Excavation of lead-contaminated soils exceeding the NRDCSRS in the open field/waste disposal area
   - Stabilization of lead-contaminated soils
   - Consolidation of stabilized soil and capping of areas of PCB contamination and remaining lead contamination in surface soils exceeding the ecological PRG in the open field/waste disposal area
3. **Scrapyard Area**
   - Capping of contaminated soils in the scrapyard area
4. **Mira Trucking**
   - Excavation of source materials and lead-contaminated soil as described in Section 3.1.1
   - Off-site disposal of excavated materials as described in Section 3.1.1
   - Site restoration as described in Section 3.1.1
5. **Others**
   - Connection to city water as described in Section 3.1.1

- Removal of lead contamination at rental home area as described in Section 3.1.1

After Remedial Construction

- Inspection and maintenance of caps
- Institutional controls: deed notices of the caps at scrapyard area and open field/waste disposal area (including the containment cell)
- Institutional controls: groundwater CEA as described in Section 3.1.1
- Long-term monitoring of groundwater and site reviews as described in Section 3.1.1

Description of remedial approaches for key components that are not listed in the common elements are provided below. These remedial approaches are conceptual; the specific details on implementation of the remedy would be determined as part of the remedial design.

On-site Containment of Source Materials

Under this alternative, the excavated source materials, which are assumed to be hazardous, would be placed in an on-site engineered containment cell above the 100-year floodplain. The containment cell would be constructed as a RCRA Subtitle C landfill with a bottom liner to prevent leaching, a leachate collection system, and an impermeable cover to minimize infiltration.

The area above the 100-year flood zone in the open field/waste disposal area is next to the Willow Woods and the scrapyard area and consists of approximately 10 acres. To minimize the overall height of this containment cell, the area for this containment cell could be excavated first and the excavated soils could be stockpiled on-site to be used as the containment cell cover. It is estimated that the height of this on-site containment cell would be approximately 6 feet above the surrounding area.

Excavation of Contaminated Soil Exceeding the Lead NRDCSRS in Open Field/Waste Disposal Area

In the open field/waste disposal area, outside the source material areas, contaminated soils exceeding the NRDCSRS for lead have been identified at a few isolated locations (Figure 3-2). An isolated area with PCB-contaminated soils exceeding the TSCA waste criteria of 50 mg/kg has also been identified (Figure 3-2). Contaminated soils in these select areas would be excavated, stabilized as necessary, and consolidated on top of the PCB-contaminated area to be capped.

Stabilization of Lead-Contaminated Soils

To minimize the leachability of lead from the excavated soils, on-site stabilization of lead would be performed. Soil concentrations of lead that would require stabilization to reduce leachability would be determined during the remedial design. For FS cost estimating purposes, it is assumed that soils containing lead concentrations greater than 800 mg/kg would be treated using a stabilization reagent to significantly reduce the leachability of lead. This on-site treatment may be carried out in a lined flat area using a backhoe to mix the reagents or through a pugmill system to mix the reagents. For cost estimating purposes, a pugmill system is assumed for this FS. The treated soils would be tested for TCLP analysis to demonstrate they are no longer hazardous.

Consolidation of Stabilized Soil and Capping of Area of PCB Contamination and Remaining Lead Contamination in Surface Soils Exceeding the Ecological PRGs in the Open Field/Waste Disposal Area

The stabilization soils will be consolidated in the open field/waste disposal area above remaining areas of PCB contamination and lead contamination above the ecological PRG in surface soil. Following consolidation, the entire area of PCB contamination and lead contamination above the ecological PRG would be covered with 1 foot of clean fill, 6 inches of top soil, and soil erosion and sediment control measures. The final grading of this area would be designed for positive drainage toward Hessian Run. During the remedial design, the total volume of imported clean fill for capping and shoreline restoration within the 100-year flood zone would be designed to prevent decreasing of flood storage capacity.

Capping the Contaminated Soils in the Scrapyard Area

The majority portion of lead- and PCB-contaminated surface and subsurface soils (0 to 4 feet bgs) in the scrapyard area are currently under asphalt. Based on the RI data, there is no indication that lead soil contamination within the scrapyard area is impacting groundwater quality. Therefore, capping of soil contamination with asphalt would be implemented at the scrapyard area to eliminate exposure to contaminants by human and ecological receptors.

Inspection and Maintenance of Caps and Containment Cell

A long-term inspection and maintenance program would be implemented to ensure the effectiveness of the caps in eliminating exposure pathways to human and ecological receptors. The caps to be inspected and maintained include (1) the soil cover and erosion control measures below the 100-year flood zone, (2) the soil cover on top of the on-site containment cell above the 100-year flood zone, and the (3) the asphalt cover at the scrapyard area.

Institutional controls – Deed Notices

Currently, a deed notice is in place for the scrapyard area to prevent activities that would compromise the integrity of the selected remedy. For this alternative, a deed notice for the open field/waste disposal area would also be developed and implemented to prevent any intrusive activities that would compromise the on-site containment cell and the cap below the 100-year flood zone.

3.1.4 Alternative 3 – Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping

Under this alternative, the excavated source materials would be disposed of off-site in contrast to Alternative 2, which calls for the source materials (battery casings, battery casings mixed with waste, and battery casings mixed with sediment) to be contained in an on-site engineered containment cell. This alternative is presented in Figure 3-3 and consists of the following components:

Prior to Remedial Action

- Pre-design investigation and remedial design as described in Section 3.1.1

1. Source Materials

- Excavation and handling of the source materials as described in Section 3.1.1
- Temporary restoration of the shoreline of Hessian Run as described in Section 3.1.1
- Off-site disposal of source materials

2. Open Field/Waste Disposal Area

- Excavation of lead-contaminated soils exceeding the NRDCSRS in the open field/waste disposal area as described in Alternative 2
- Stabilization of lead-contaminated soils as described in Alternative 2
- Consolidation of stabilized soil and capping of area of PCB contamination and remaining lead contamination in surface soils exceeding the ecological PRG in the open field/waste disposal area as described in Alternative 2

3. Scrapyard Area

- Capping the contaminated soils in the scrapyard area as described under Alternative 2

4. Mira Trucking

- Excavation of source materials and lead-contaminated soil as described in Section 3.1.1
- Off-site disposal of excavated materials as described in Section 3.1.1
- Site restoration as described in Section 3.1.1

5. Others

- Connection to city water as described in Section 3.1.1
- Removal of lead contamination at rental home area as described in Section 3.1.1

After Remedial Construction

- Inspection and maintenance of caps as described under Alternative 2
- Institutional controls: deed notices of the caps at scrapyard and open field/waste disposal areas as described under Alternative 2
- Institutional controls: groundwater CEA as described in Section 3.1.1
- Long-term monitoring of groundwater and site reviews as described in Section 3.1.1

Off-site Disposal of Source Materials

The source materials (battery casings and waste, soil, sediment mixed with battery casings) would be shipped off-site to be treated as necessary and disposed of in a Subtitle C landfill. In general, battery casings are considered hazardous waste because the casings contain lead and acid. During the PDI, samples may be collected from different locations of source materials for

TCLP analysis to characterize the battery casings, waste, soil, and sediment to evaluate if additional treatment would be necessary prior to placement in a Subtitle C landfill. Prior to off-site disposal, samples would also be collected to meet the requirements of the waste disposal facilities.

3.1.5 Alternative 4 – Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping

Under this alternative, all the excavated materials, including the source materials and contaminated soils exceeding the PRGs in the open field/waste disposal area, would be disposed of off-site. This alternative is presented in Figure 3-4 and consists of the following components:

Prior to Remedial Action

- Pre-design investigation and remedial design as described in Section 3.1.1

Remedial Action

1. Source Materials and Sediment

- Excavation of source materials as described in Section 3.1.1
- Off-site disposal of source materials as described in Alternative 3
- Temporary restoration of the shoreline of Hessian Run as described in Section 3.1.1

2. Open Field/Waste Disposal Area

- Excavation of contaminated soil exceeding the PRGs
- Off-site disposal of excavated soil
- Restoration of the open field/waste disposal area

3. Scrapyard Area

- Capping the contaminated soils in the scrapyard area as described under Alternative 2

4. Mira Trucking

- Excavation of source materials and lead-contaminated soil as described in Section 3.1.1
- Off-site disposal of excavated materials as described in Section 3.1.1
- Site restoration as described in Section 3.1.1

5. Others

- Connection to city water as described in Section 3.1.1
- Removal of lead contamination at rental home area as described in Section 3.1.1

After Remedial Construction

- Inspection and maintenance of the cap at the scrapyard area as described under Alternative 2
- Institutional controls: deed notices of the cap at scrapyard area as described under Alternative 2
- Institutional controls: groundwater CEA as described in Section 3.1.1
- Long-term monitoring of groundwater and site reviews as described in Section 3.1.1

Excavation of Contaminated Soil Exceeding the PRGs in the Open Field/Waste Disposal Area

The contaminated surface and subsurface soils exceeding the PRGs would be excavated. The excavation would extend 1 to 4 feet bgs for the majority areas requiring excavation. At two locations (one near the north of the site near the former smelting area [Figure 3-4] and the other in the area of deep PCB contamination [Figure 3-4]), excavation would extend to 8 feet bgs. To reach this depth, the sidewall of the excavation would be benched. Soils excavated from the sidewall would be stockpiled separately from the contaminated soils. PCB concentration at one location, boring SB-113, exceeded 50 mg/kg and is TSCA waste. Soil excavated from this location would be stockpiled separately and transported and disposed of in accordance with TSCA regulations.

Post-excavation sampling and analysis would be performed in accordance with NJDEP regulation. Post-excavation samples collected above the mean high-water line and exceeding the PRGs would require secondary excavation. However, post-excavation samples collected below the mean high-water line would only be used to document the levels of contamination in those areas only. No secondary excavation would be performed as those materials would be considered sediment to be addressed as part of OU3.

Off-site Disposal of Excavated Materials

In addition to source materials being disposed off-site as described under Alternative 3, all excavated soils would also be disposed off-site under this alternative. Waste characterization would be conducted prior to off-site disposal. It is anticipated that excavated soils containing PCB concentrations greater than 50 mg/kg would be disposed of at a TSCA landfill, excavated soils characterized as hazardous would be disposed of at a Subtitle C landfill, and excavated soils characterized as non-hazardous would be disposed of at a Subtitle D landfill.

Restoration of the Open Field/Waste Disposal Area

Following the removal of contaminated soil, the area would be restored where necessary to its pre-impacted (pre-landfilled) grade and graded for positive drainage toward Hessian Run. Since the area is within a 100-year flood zone, erosion control measures would be implemented. Vegetation would be restored to match pre-removal conditions. For areas above the mean high-water line, the restoration would be designed to be permanent. For areas below the mean high-water line, the restoration would be temporary, accounting for any future remediation that may be completed as part of OU3.

3.1.6 Alternative 5 – Excavation and Off-site Disposal

Under this alternative, the source materials and contaminated soils in the open field/waste disposal area and scrapyard would be excavated and disposed off-site. This alternative is presented in Figure 3-5 and consists of the following components:

Prior to Remedial Action

- Pre-design investigation and remedial design as described in Section 3.1.1

Remedial Action

1. Source Materials

- Excavation of source materials as described in Section 3.1.1
- Off-site disposal of source materials as described under Alternative 3
- Temporary restoration of the shoreline of Hessian Run as described in Section 3.1.1

2. Open Field/Waste Disposal Area

- Excavation of contaminated soils exceeding the PRGs as described under Alternative 4
- Off-site disposal of excavated materials as described under Alternative 4
- Restoration of the open field/waste disposal area as described under Alternative 4

3. Scrapyard Area

- Excavation of contaminated soils exceeding the PRGs in the scrapyard area
- Off-site disposal of excavated soils
- Restoration of the scrapyard area

4. Mira Trucking

- Excavation of source materials and lead-contaminated soil as described in Section 3.1.1
- Off-site disposal of excavated materials as described in Section 3.1.1
- Site restoration as described in Section 3.1.1

5. Others

- Connection to city water as described in Section 3.1.1
- Removal of lead contamination at rental home area as described in Section 3.1.1
- Off-site disposal of excavated soils as described under Alternative 4

After Remedial Construction

- Institutional controls: groundwater CEA
- Long-term monitoring of groundwater and site reviews as described in Section 3.1.1

Excavation and Off-site Disposal of Contaminated Soils Exceeding the PRGs in the Scrapyard Area

Contaminated soils exceeding the PRGs would be excavated and disposed off-site. The excavation can be conducted using regular excavation equipment. The excavated area would be backfilled with imported clean fill. The current operation at the scrapyard area would most likely need to be temporarily shut down or partially shut down for the remediation.

Restoration of the Scrapyard Area

The ground surface at the scrapyard area would be restored to pre-construction conditions with asphalt, imported clean fill, and vegetation.

3.2 Alternative Screening

Since only a limited number of remedial alternatives were developed, all the alternatives are carried forward through the detailed description and evaluation. Screening of remedial action alternatives is not performed.

Section 4

Detailed Analysis of Remedial Action Alternatives

The remedial alternatives described in Section 3 are evaluated in this section against the criteria described below.

4.1 Evaluation Criteria

EPA's nine evaluation criteria address statutory requirements and considerations for remedial actions in accordance with the NCP and additional technical and policy considerations proven to be important for selecting among remedial alternatives (EPA 1988). The following subsections describe the nine evaluation criteria used in the detailed analysis of remedial alternatives.

CDM Smith has performed a preliminary vulnerability evaluation of the remedial alternatives included in this FS as a first step toward identifying, prioritizing, and implementing site-specific measures for increasing resilience to climate change impacts. Appendix D includes a table identifying potential climate change impacts that could prove disruptive, vulnerabilities, and potential high-priority adaptation measures that could be implemented. It is expected that the table will be revised and detailed through subsequent project phases, monitoring measures and tracking modifications over time.

4.1.1 Overall Protection of Human Health and the Environment

Each alternative is assessed to determine whether it can provide adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site. Evaluation of this criterion focuses on how site risks are eliminated, reduced, or controlled through treatment, engineered controls, or institutional controls and whether an alternative poses any unacceptable cross-media impacts.

4.1.2 Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S. Code § 9621(d), the NCP, 40 CFR Part 300 (1990), and guidance and policy issued by EPA require that remedial actions under CERCLA comply with substantive provisions of ARARs from the state and federal environmental laws and commonwealth facility siting laws during and at the completion of the remedial action.

4.1.2.1 Identification of ARARs

The definition and identification of ARARs have been described and discussed in detail in Section 2.2. Three classifications of requirements are defined by EPA in the ARAR determination process. ARARs are defined as chemical-, location-, or action-specific. An ARAR can be one or a combination of all three types. The federal and New Jersey ARARs for the site are listed in Tables 2-1 and 2-2. Each alternative is evaluated to determine how chemical- and action-specific ARARs would be met.

4.1.3 Long-Term Effectiveness and Permanence

Long-term effectiveness evaluates the likelihood that the remedy would be successful and the permanence it affords. Factors to be considered, as appropriate, are discussed below.

- Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the end of the remedial activities. The characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their T/M/V and propensity to bioaccumulate.

- Adequacy and reliability of controls used to manage treatment residuals and untreated waste remaining at the site. This factor includes an assessment of containment systems and institutional controls to determine if they are sufficient to ensure any exposure to human and ecological receptors is within protective levels. This factor also addresses the long-term reliability of management controls for providing continued protection from residuals, the assessment of the potential need to replace technical components of the alternative, and the potential exposure pathways and risks posed should the remedial action need replacement.

4.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Each alternative is assessed for the degree to which it employs a technology to permanently and significantly reduce T/M/V, including how treatment is used to address the principal threats posed by the site. Factors to be considered, as appropriate, include the items below.

- The treatment processes the alternatives employ and materials they would treat

- The amount of hazardous substances, pollutants, or contaminants that would be destroyed or treated, including how the principal threat(s) would be addressed

- The degree of expected reduction in T/M/V of the waste due to treatment

- The degree to which the treatment is irreversible

- The type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents

- Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action

4.1.5 Short-Term Effectiveness

This criterion reviews the effects of each alternative during the construction and implementation phase of the remedial action until remedial response objectives are met. The short-term impacts of each alternative are assessed, considering the following factors, as appropriate.

- Short-term risks that might be posed to the community during implementation of an alternative

- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures
- Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts
- Time until protection is achieved for either the entire site or individual elements associated with specific site areas or threats

4.1.6 Implementability

The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation is evaluated under this criterion. The ease or difficulty of implementing each alternative is assessed by considering the following factors:

Technical Feasibility

- Technical difficulties and unknowns associated with the construction and operation of a technology
- Reliability of the technology, focusing on technical problems that will lead to schedule delays
- Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions

Administrative Feasibility

- Activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions)

Availability of Services and Materials

- Availability of adequate off-site treatment, storage capacity, and disposal capacity and services
- Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources

4.1.7 Cost

Detailed cost estimates for each alternative were developed for the FS according to *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000). Detailed cost estimates for the alternatives are included in Appendix E and include the following:

- Capital costs
- Annual O&M costs
- Periodic costs

- Present value of capital and annual O&M costs

4.1.8 State (Support Agency) Acceptance

Commonwealth (support agency) acceptance is a modifying criterion under the NCP. Assessment of commonwealth acceptance will not be completed until comments on the final FS report are submitted to EPA. Thus, commonwealth acceptance is not considered in the detailed analysis of alternatives presented in the FS.

4.1.9 Community Acceptance

Community acceptance is also a modifying criterion under the NCP. Assessment of community acceptance will include responses to questions that any interested person in the community may have regarding any component of the remedial alternatives presented in the final FS report. This assessment will be completed after EPA receives public comments on the proposed plan during the public comment period. Thus, community acceptance is not considered in the detailed analysis of alternatives presented in the FS.

4.2 Detailed Analysis of Remedial Alternatives

This section provides detailed analysis of the remedial alternatives developed in Section 3 for the site. Table 4-1 presents a side-by-side view of the criteria analysis for all the alternatives. The remedial alternatives retained for detailed analysis are summarized below.

4.2.1 Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to reduce contaminant mass and to restore the contaminated area. This alternative would not meet the RAOs.

Compliance with ARARs

TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs. This alternative would not meet the PRGs since no action would be taken. Location- and action-specific ARARs do not apply to this alternative.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the contaminated source materials, soils, and sediment would not be addressed. There would be no change to the magnitude of residual contamination since no action would be taken to reduce or remove the contaminants. The No Action alternative provides no controls of the contamination nor any measures to control human health risks and ecological risks. The No Action alternative would not provide any mechanism to monitor the migration and degradation of contaminants.

Reduction of T/M/V through Treatment

No reductions of contaminant T/M/V through treatment would be achieved under this alternative. There is no provision in this alternative to monitor the changes in contaminant concentrations.

Short-Term Effectiveness

Since no remedial action would be implemented at the site, this alternative would not pose a short-term impact to on-site workers, the local community, and the ecological receptors.

Implementability

This alternative could be implemented immediately since no services or actions would be required.

Cost

There are no capital or O&M costs associated with this alternative.

4.2.2 Alternative 2 – Excavation, On-site Containment of Source Materials, Stabilization, and Capping

Overall Protection of Human Health and the Environment

This alternative would provide overall protection of human health and the environment. The exposure pathways to human and ecological receptors would be eliminated or reduced by containment of source materials in an engineered cell and stabilization and capping of contaminated soils. The engineered cell and the caps would need to be inspected and maintained regularly. Institutional controls preventing intrusive activities that could compromise the protectiveness of the engineering cell and caps would need to be implemented for continuous protection of human health and the environment.

The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.

Compliance with ARARs

TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs for the contaminated soils. EPA's memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" is a TBC. This alternative would meet the PRGs since the source materials and contaminated soils exceeding the PRGs would be removed, contained, stabilized, and capped. Groundwater would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met by following the health and safety requirements and complying with all necessary regulations and permits. The CAMU rule would allow ex situ treatment and consolidation of hazardous waste on-site without meeting the LDR treatment standards as discussed under Section 2.2.2.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence.

Magnitude of Residual Risk: The magnitude of residual risk is low. The source materials would be contained in an engineered containment cell. The contaminated soils in the open field/waste disposal area would be excavated, stabilized, and/or capped. The lead- and PCB-contaminated soils in the scrapyard area would be capped in the scrapyard area. Exposure pathways to human and ecological receptors would be eliminated or minimized.

Adequacy and Reliability of Controls: The adequacy and reliability of the caps rely on the routine inspection and maintenance and the effective enforcement of institutional controls. The integrity of the cover of the engineered containment cell and the cap with erosion control measures in the

100-year flood zone would need to be closely monitored and properly maintained to ensure continued protection to human health and the environment.

Reduction of T/M/V through Treatment

This alternative would reduce mobility of lead-contaminated soils through on-site stabilization. No treatment would be performed to reduce the toxicity and volume.

Short-Term Effectiveness

This alternative would involve approximately 3 to 3.5 years of on-site construction operations, which would increase local traffic due to the commute of construction workers, transportation of large construction equipment, and importing of materials. Construction would generate noise during the day, which would be controlled to minimize impact to the Willow Woods community. Capping of soils at the scrapyard area may require coordination with the existing operation. The on-site containment of source materials above the 100-year flood zone would be approximately 6feet high and would change the topography of the area. Capping of treated soil on top of the PCB-contaminated area would result in a grade change approximately 2 feet higher than existing grade. The drainage pattern would be designed to ensure that stormwater runoff would be directed to Hessian Run and would not impact the scrapyard area or the Willow Woods community.

Implementability

This alternative is implementable. Equipment and experienced vendors for excavation, backfill, and on-site stabilization of lead-contaminated materials are commercially available. Even though building an earthen berm for excavation along Hessian Run is assumed in this FS for cost estimating purposes, other methods that would prevent the excavated area from being impacted by inundating tides would also be evaluated and may be more cost-effective than an earthen berm. Construction of the engineered containment cell (like a Subtitle C landfill) is technically complex and may raise concerns from the local community. Measures for soil erosion controls along Hessian Run are also proven technologies. The temporary restoration of the shoreline of Hessian Run could be designed to account for any future remediation that may be completed as part of OU3.

The long-term inspection and maintenance of the caps might be challenging. EPA and NJDEP would need to develop a plan and provide funding for this activity to ensure continued protection of human health and the environment.

Cost

The capital cost is $33.3 million. The annual O&M cost is $435,000. The present worth cost of this alternative is $38.5 million for 30 years.

4.2.3 Alternative 3 – Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping

Overall Protection of Human Health and the Environment

This alternative would provide overall protection of human health and the environment. The exposure pathways to human and ecological receptors would be eliminated or reduced by removal of source materials from the site and stabilization and capping of contaminated soils. The cap would need to be inspected and maintained regularly, and institutional controls would need to be implemented for continuous protection of human health and the environment.

The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.

Compliance with ARARs

TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs for surface soils. EPA's memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" is a TBC. This alternative would meet the PRGs since the source materials would be removed from the site and contaminated soils exceeding the PRGs would be stabilized and capped. Groundwater will be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met by following the health and safety requirements and complying with all necessary regulations and permits. The CAMU rule would allow treatment and disposal of hazardous wastes on-site underneath a cap without meeting the LDR treatment standards.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence.

Magnitude of Residual Risk: The magnitude of residual risk is minimal. The source materials would be removed from the site. The contaminated soils in the open field/waste disposal area would be excavated, stabilized, and capped together with the PCB-contaminated soils in the open field/waste disposal area. The contaminated soils at the scrapyard area would be capped. Therefore, this alternative would eliminate or minimize the exposure pathways to human and ecological receptors.

Adequacy and Reliability of Controls: The adequacy and reliability of the soil caps rely on the routine inspection and maintenance of the caps and the effective enforcement of institutional controls. Erosion or damage of the cap may expose the stabilized contaminants and PCB-contaminated soils, which would be prevented through routine inspection and maintenance.

Reduction of T/M/V through Treatment

This alternative would reduce mobility of lead contaminants through on-site stabilization. The hazardous source materials would be shipped off-site and treated to meet Universal Treatment Standards (UTS) prior to landfill disposal. The toxicity and volume of contamination would not change through treatment.

Short-Term Effectiveness

This alternative would involve approximately 2.5 to 3 years of operation, which would increase local traffic due to the commute of construction workers, transportation of large construction equipment, importing materials, and off-site disposal of the large quantity of source materials. Construction would generate noise and dust during the day, which would be controlled to minimize impacts to the Willow Wood community. Capping of contaminated soils at the scrapyard area would require coordination with the existing operation.

Consolidation and capping of lead- and PCB-contaminated soils in the open field/waste disposal area would result in a grade change approximately 2 feet higher than existing grade. The drainage pattern would be designed to ensure that stormwater runoff would be directed to Hessian Run and would not impact the scrapyard area or the Willow Woods community.

Implementability

This alternative is implementable. Equipment and experienced vendors for excavation, backfill, and on-site stabilization of lead-contaminated soils and capping of contaminated soils are commercially available. Even though building an earthen berm for excavation along Hessian Run is assumed in this FS for cost estimating purposes, other methods that would prevent the excavated area from impacts of inundating tide would also be evaluated and potentially may be more cost-effective than an earthen berm. Measures for soil erosion controls along Hessian Run are also proven technologies. The temporary restoration of the shoreline of Hessian Run could be designed to account for any future remediation that may be completed as part of OU3.

The long-term inspection and maintenance of the caps might be challenging, especially for the open field/waste disposal area. A deed notice is in place for the scrapyard area to prevent activities that might compromise the effectiveness of the selected remedy. EPA and NJDEP would need to develop a plan and provide funding for this activity to ensure continued protection of human health and the environment.

Cost

The capital cost is $65.8 million. The annual O&M cost is $124,000. The present worth cost of this alternative is $67.0 million for 30 years.

4.2.4 Alternative 4 – Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping

Overall Protection of Human Health and the Environment

This alternative would provide overall protection of human health and the environment. The exposure pathways to human and ecological receptors would be eliminated or reduced by removal of source materials and contaminated soils exceeding the PRGs and capping of contaminated soil at the scrapyard area. The cap at the scrapyard area would need to be inspected and maintained, and institutional controls would need to be implemented for continuous protection of human health and the environment. A deed notice is in place for the scrapyard area to prevent activities that might compromise the effectiveness of the selected remedy.

The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.

Compliance with ARARs

TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs for surface soils. EPA's memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" is a TBC. This alternative would meet the PRGs since the source materials and contaminated soils from the open field would be removed from the site and contaminated soils in the scrapyard area would be capped. Groundwater would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met by following the health and safety requirements and complying with all necessary regulations and permit requirements.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence.

Magnitude of Residual Risk: The magnitude of residual risk is low since the source materials and contaminated soils in the open field/waste disposal area would be excavated and disposed off-site. The PCB- and lead-contaminated soils at the scrapyard area would be capped to eliminate the exposure pathways to human and ecological receptors.

Adequacy and Reliability of Controls: The adequacy and reliability of the soil and asphalt caps at the scrapyard area rely on routine inspection and maintenance of the caps and enforcement of the institutional controls.

Reduction of T/M/V through Treatment

This alternative would eliminate the T/M/V of source materials, contaminated sediment, and lead- and PCB-contaminated soils from the open field/waste disposal area from the site since they would be shipped for off-site disposal. The source materials and contaminated soil would be treated to meet UTS under LDRs prior to disposal in landfill(s). The toxicity would not be reduced by capping. The volume of the stabilized lead- and solidified PCB-contaminated soils would not change at the scrapyard area.

Short-Term Effectiveness

This alternative would involve approximately 3 to 3.5 years of operation and significantly increase local traffic due to the commute of construction workers, transportation of large construction equipment, importing of materials, and off-site disposal of the large quantity of materials (125,000 tons) and contaminated sediment and soils. Construction would generate noise and dust during the day, which would be controlled to minimize impact to the Willow Wood community. In situ stabilization of soils at the scrapyard area may require temporary shutdown of a portion of the existing operation.

Implementability

This alternative is implementable. Equipment and experienced vendors for excavation, backfill, and off-site disposal are readily available. Even though building an earthen berm is assumed in this FS for cost estimating purposes for excavation along Hessian Run, other methods that would keep the excavated area from impact by inundating tide would also be evaluated and potentially may be more cost-effective than an earthen berm. Measures for soil erosion controls and wetland restoration along Hessian Run are also proven technologies. The temporary restoration of the shoreline of Hessian Run could be designed to account for any future remediation that may be completed as part of OU3.

The long-term inspection and maintenance of the cap at the scrapyard area would be implementable. EPA and NJDEP would need to develop a plan and provide funding for this activity to ensure continued protection of human health and the environment. A deed notice is in place for the scrapyard area to prevent any intrusive activities that might reduce the effectiveness of the selected remedy.

Cost

The capital cost is $71.5 million. The annual O&M cost is $85,000. The present worth cost of this alternative is $72.2 million for 30 years.

4.2.4 Alternative 5 – Excavation and Off-Site Disposal

Overall Protection of Human Health and the Environment

This alternative would provide the highest level of overall protection of human health and the environment. The exposure pathways to human and ecological receptors would be eliminated by removal of source materials and all contaminated soils exceeding the PRGs from the site.

The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.

Compliance with ARARs

TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs for surface and subsurface soils. EPA's memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" is a TBC. This alternative would meet the PRGs since the source materials and contaminated soils from all contamination areas would be removed from the site. Groundwater would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met by following the health and safety requirements and complying with all necessary regulations and permits.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence.

Magnitude of Residual Risk: The magnitude of residual risk is low since the source materials and contaminated soils in the open field/waste disposal area and scrapyard would be excavated and disposed off-site. Contaminated sediment would be addressed under OU3.

Adequacy and Reliability of Controls: No control measures would be necessary since source materials and contaminated soil above the PRGs would be removed from the site.

Reduction of T/M/V through Treatment

This alternative would achieve reduction of T/M/V on-site by removing source materials and contaminated soils above the PRGs from the site. The source materials and contaminated soil would be treated to meet UTS under LDRs prior to disposal in landfill(s). The T/M/V of the contamination would be transferred to the landfills.

Short-Term Effectiveness

This alternative would involve approximately 3 to 3.5 years of operation and would significantly increase local traffic due to the commute of construction workers, transportation of large construction equipment, importing of materials, and off-site disposal of all contaminated materials. Construction would generate noise during the day, which would be controlled to minimize impact to the Willow Woods community.

Implementability

This alternative is implementable. Equipment and experienced vendors for excavation, backfill, on-site stabilization of lead-contaminated materials, and shoreline restoration are commercially available. Even though building an earthen berm is assumed in this FS for cost estimating purposes for excavation along Hessian Run, other methods that would keep the excavated area from impact by inundating tide would also be evaluated and potentially may be more cost-effective than an earthen berm. Measures for soil erosion controls along Hessian Run are also proven technologies. The temporary restoration of the shoreline of Hessian Run could be designed to account for any future remediation that may be completed as part of OU3.

Cost
The capital cost is $82.0 million. The annual monitoring cost is $50,000. The present worth cost of this alternative is $82.4 million.

4.3 Comparative Analysis of Remedial Alternatives

This section provides a comparison among the five alternatives against the seven criteria.

Overall Protection of Human Health and the Environment
Alternative 1 would not provide protection of human health and the environment since no action would be taken to eliminate the exposure pathways to human and ecological receptors and no action would be taken to remediate site contamination. Alternatives 2, 3, 4, and 5 would achieve the RAOs and would provide protection to human health and the environment. The exposure pathways to human and ecological receptors would be eliminated or significantly reduced. Under Alternative 2, the source materials would be contained in an on-site engineered containment cell. Under Alternatives 3, 4, and 5, the source materials would be removed from the site and disposed off-site. Under Alternatives 2 and 3, excavated contaminated soil with elevated lead concentration would be stabilized prior to being consolidated under a cap. Under Alternatives 4 and 5, all excavated soils would be disposed off-site. Under Alternatives 2, 3, and 4, the caps would need to be inspected and maintained. All alternatives include institutional controls that would need to be implemented for continuous protection of human health and the environment. Alternative 5 provides the highest degree of protection to human health and the environment since source materials and all soil contamination would be removed from the site; however, institutional controls would still be put in place for groundwater until the groundwater PRGs are met by removing the source materials.

Under Alternatives 2 through 5, the shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.

Compliance with ARARs
TSCA and the NJDEP-promulgated NRDCSRS and RDCSRS are chemical-specific ARARs for contaminated soils. EPA's memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" is a TBC. Alternative 1 would not meet the chemical-specific ARARs or the PRGs since no action would be taken. Alternatives 2 through 5 would comply with the chemical-specific ARARs and would meet the PRGs since the source materials and contaminated soil would be treated and contained or removed from the site. Groundwater would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met by following the health and safety requirements and complying with all necessary regulations and permits. CAMUs would be used for Alternatives 2 and 3 for on-site containment of hazardous materials in an engineered cell and on-site treatment of hazardous soil and consolidation of treated soil under a cap.

Long-Term Effectiveness and Permanence
Alternative 1 would not provide any long-term effectiveness and permanence since no action would be taken to remove the contamination or eliminate the exposure pathways to human and

ecological receptors. Alternative 5 provides the highest long-term effectiveness and permanence. Alternatives 2 through 4 would provide long-term effectiveness and permanence to varying degrees as discussed below.

Magnitude of Residual Risk: Alternative 5 would not have any residual risks since all source materials and contaminated soils would be removed from the site. The magnitude of residual risks of Alternatives 2 to 4 depends on the reliability of the engineered cell and/or the caps in preventing exposure of human and ecological receptors to the contaminants. Based on the amount of contaminated materials remaining on-site, Alternative 4 has less potential residual risk than Alternative 3 followed by Alternative 2 because all excavated source materials and contaminated soils would be removed from the site in Alternative 4. Only source materials would be removed from the site in Alternative 3, and the source materials and contaminated soils would be contained on-site in Alternative 2.

Adequacy and Reliability of Controls: The adequacy and reliability of the engineered cell and soil caps under Alternatives 2 through 4 rely on routine inspection and maintenance of the engineered cell and the caps, and all alternatives rely on the effective enforcement of the institutional controls. Without adequate inspection and maintenance, erosion or damage of the caps may expose the source materials and contaminated soils to receptors. The requirement for maintaining the integrity of caps for Alternative 2 is the highest since Alternative 2 consists of an engineered cell and large capped areas in both the open field/waste disposal area and the scrapyard area, followed by Alternative 3 (capped areas both in the open field/waste disposal area and in the scrapyard area), then Alternative 4 (only the capped areas in the scrapyard area). Since a large capped area in the open field/waste disposal area under Alternatives 2 and 3 is below the 100-year flood zone, the requirements for inspection and maintenance of this cap would be higher than for Alternative 4. For Alternative 5, less control measures for residual contamination would be required since source materials and all soil contamination would be removed from the site; however, institutional controls would still be put in place for groundwater until the groundwater PRGs are met by removing the source materials.

Reduction of T/M/V through Treatment

Alternative 1 would not reduce toxicity, mobility, or volume (T/M/V) through treatment since no action would be taken. Alternatives 2 through 5 would reduce the mobility of the contaminants to different degrees through treatment. Alternative 2 would reduce the mobility of contaminants through on-site stabilization of excavated soils; Alternative 3 would reduce the mobility of the source materials through treatment to meet the UTS prior to landfill disposal and reduce the mobility of contaminants in excavated soils through on-site stabilization; Alternatives 4 and 5 would reduce mobility of source materials and excavated hazardous soils through off-site treatment to meet the UTS prior to landfill disposal. There is no reduction of volume and toxicity of contamination through treatment under Alternatives 2 to 5.

Short-Term Effectiveness

Alternative 1 would not have any short-term impacts since no action would be taken. Alternative 5 would have the highest short-term impact to the local community because it includes transportation of the most contaminated materials for off-site disposal and the highest amount of materials to be imported for site restoration. Alternative 5 would also most likely require temporary shutdown of the existing operation at the scrapyard area. The short-term impact to the local community for Alternative 2 and Alternative 4 may be similar because Alternative 2 would require the construction of an on-site containment cell while Alternative 4 would require a larger quantity of contaminated soil to be excavated and transported off-site compared to Alternative 2. Alternative 3 would cause the least short-term impact to local community compared to Alternatives 2, 4, and 5 because the volume of contaminated materials to be excavated and handled under this alternative is less than Alternatives 4 and 5 and it does not require the construction of an on-site containment cell as per Alternative 2. Construction would generate noise and dust during the day, which would be controlled to minimize impact to the Willow Woods community. Construction or improvement of a cap at the scrapyard area under Alternatives 2 through 4 would require coordination with the existing operation.

Alternative 3 has the shortest construction duration of approximately 2.5 to 3 years. The construction duration for Alternatives 2, 4, and 5 were estimated to be approximately 3 to 3.5 years.

The on-site containment of hazardous waste in an engineered containment cell under Alternative 2 would raise the elevation by approximately 6 feet and may be viewed unpleasant by the local community. A monitoring program would be developed to ensure the integrity of the containment cell as designed. The consolidation and capping of contaminated soil in the open field/waste disposal area under Alternatives 2 and 3 would be approximately 2 feet higher than existing grade. The drainage pattern would be designed to ensure that stormwater runoff would be directed to Hessian Run and would not impact the scrapyard area or the Willow Woods property.

Implementability

Alternative 1 is easiest to implement since no action would be taken. Alternatives 2 through 5 are implementable. Equipment and experienced vendors for excavation, backfill, on-site stabilization of lead-contaminated soils, construction of an engineered containment cell, and shoreline restoration are commercially available. Even though building an earthen berm is assumed in this FS for cost estimating purposes for excavation along Hessian Run, other methods that would keep the excavated area from impact by inundating tide would also be evaluated and potentially may be more cost-effective than an earthen berm. Measures for soil erosion controls and wetland restoration along Hessian Run are also proven technologies.

Alternative 2 has the highest complexity in design, implementation, and long-term monitoring since it involves the design and construction of a Subtitle C landfill.

For Alternatives 2 through 4, a long-term monitoring and maintenance plan would need to be developed for the on-site containment cell, the cap in the open field/waste disposal area, and the cap in the scrapyard area. Funding would need to be set aside for this activity to provide for continued protection of human health and the environment. Alternative 4 has less long-term monitoring and maintenance than Alternatives 2 and 3 since the only capped area is at the scrapyard area. There are no inspection and maintenance requirements under Alternative 5.

Alternatives 2 through 5 would require varying levels of institutional controls. For Alternative 4, a deed notice is already in place to prevent any activities that may compromise the effectiveness of the selected remedy. For all alternatives, a groundwater CEA would be established until the groundwater PRGs are met by removing the source materials.

Cost

A summary of the costs for the alternatives is presented on Table 4-2. Alternative 1 has the lowest present worth costs since no action would be taken. Alternative 5 has the highest present worth costs due to the high costs for off-site disposal of the large volume of contaminated soils and waste, but Alternative 5 has negligible O&M costs. Alternative 4 has the second highest present worth cost, followed by Alternative 3, then Alternative 2.

Section 5

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Tables

Table 1-1
Summary of Cancer Risks and Noncancer Health Hazards for Non-residential receptors
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Receptor	Cancer Risk[1]				Noncancer Hazard Index[2]				Risk from Lead[3]
	Reasonable Maximum Exposure		Central Tendency Exposure		Reasonable Maximum Exposure		Central Tendency Exposure		
	Total	Major Risk Driver[4]	Total	Major Risk Driver	Total	Organ/Effect (Major Risk Driver)[4]	Total	Organ/Effect (Major Risk Driver)	Adverse Health Effect? (Yes or No)
Current/Future Land Use									
Site Worker									
Scrapyard Area	**3×10^{-4}**	§ Aroclor 1260 (3×10^{-4})	3×10^{-5}	--	**20**	Aroclor 1260 § HI Eye: 19 § HI Finger Nail: 19 § HI Immune System: 19	**5**	Aroclor 1260 § HI Eye: 5 § HI Finger Nail: 5 § HI Immune System: 5	No
Trespasser									
Open Field/Waste Disposal Area/ Woodbury Creek/Hessian Run	**1×10^{-4}**	--	--	--	**2**	§ HI Kidney: 2	0.5	--	**Yes** (in SS and SW)
Recreational User									
Open Field/Waste Disposal Area	3×10^{-6}	--	--	--	0.6	--	--	--	**Yes**
Angler (adult)									
Woodbury Creek/Hessian Run	**2×10^{-4}**	PCBs in fish § Aroclor 1248 (3×10^{-5}) § Aroclor 1254 (9×10^{-5}) § Aroclor 1260 (6×10^{-5})	8×10^{-6}	--	**11**	Aroclors 1254 and 1260 in fish § HI Eye: 11 § HI Finger Nail: 11 § HI Immune System: 11	**1**	--	**Yes** (in fish)
Angler (child) [5]									
Woodbury Creek/Hessian Run	7×10^{-5}	--	--	--	**17**	Aroclors 1254 and 1260 in fish § HI Eye: 17 § HI Finger Nail: 17 § HI Immune System: 17	**2**	Aroclors 1254 and 1260 in fish § HI Eye: 2 § HI Finger Nail: 2 § HI Immune System: 2	**Yes** (in fish)
Future Land Use									
Construction Worker									
Willow Woods Property	3×10^{-7}	--	--	--	0.04	--	--	--	No
Matteo Property	8×10^{-6}	--	--	--	**9**	Aroclors 1254 and 1260 in SS/SB § HI Eye: 9 § HI Finger Nail: 9 § HI Immune System: 9	--	--	**Yes** (in SS/SB)

PCBs = polychlorinated biphenyls SS = surface soil SW = surface water SB = subsurface soil

[1] Bolded values exceed EPA's target range of 1 in 1,000,000 to 1 in 10,000.

[2] Bolded values exceed EPA's threshold of unity (1).

[3] Lead concentration exceeds one or more of the following screening criteria:
EPA Regional Screening Level (RSL) for residential soil: 400 milligram per kilogram (mg/kg
EPA RSL for industrial soil: 800 mg/kg
New Jersey Groundwater Quality Standards for Class IIA Water: 5 micrograms per liter (µg/L
New Jersey Surface Water Quality Criteria for Fresh Water(Human Health): 5 µg/l
EPA Region 2 Screening Level for Fish: 0.1 mg/kg

[4] Major risk drivers include those chemicals that contribute more than 10% of the total cancer risk or cancer risk greater than 10^{4} or have an HI greater than 1.

[5] The angler scenario for children (0 to 6 years old) assumes children will eat fish caught at the site by adult anglers.

[6] Mira Trucking is not included in this assessment. A human health risk evaluation for only lead was performed for the Mira Trucking property, and is detailed in the Remedial Investigation Addendum (CDM Smith 2019)

Table 1-2
Summary of Cancer Risks and Noncancer Health Hazards for Residents
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Receptor	Cancer Risk[1]					Noncancer Hazard Index[2]				Risk from Lead[3]
	Reasonable Maximum Exposure			Central Tendency Exposure		Reasonable Maximum Exposure		Central Tendency Exposure		
	Total	Major Risk Driver[4]	Percent of Total Risk	Total	Major Risk Driver	Total	Organ/Effect (Major Risk Driver)[4]	Total	Organ/Effect (Major Risk Driver)	Adverse Health Effect? (Yes or No)
Current Land Use										
Willow Woods Property	7×10^{-5}	--	--	--	--	0.5	--	--	--	No
Matteo Property[5]	**1×10^{-2}**	§ cPAH in SS (9×10^{-3}) § Vinyl Chloride in GW (4×10^{-4}) § Arsenic in GW (6×10^{-4})	89% 4% 6%	**4×10^{-3}**	§ cPAH in SS (3×10^{-3}) § Vinyl Chloride in GW (1×10^{-4}) § Arsenic in GW (1×10^{-4})	**28**	§ HI Blood: 15 (antimony in GW) § HI Kidney: 4 (vanadium in GW) § HI Longevity: 15 (antimony in GW) § HI Skin: 6 (arsenic in GW) § HI GI Tract: 2 (iron in GW)	**9**	§ HI Blood: 4 (antimony in GW) § HI Kidney: 1 § HI Longevity: 4 (antimony in GW) § HI Skin: 2 (arsenic in GW)	**Yes** (in GW)
	3×10^{-3}	Total cumulative risk excluding soil outlier				**28**	HI excluding soil outlier			
	9×10^{-3}	Total cumulative risk using only PW-1 and PW-2 results to estimate risks from groundwater				1	HI using only PW-1 and PW-2 results to estimate HI from groundwater			
	6×10^{-5}	Total cumulative risk excluding soil outlier and using only PW-1 and PW-2 results to estimate risks from soil and groundwater, respectively				**1**	HI excluding soil outlier and using only PW-1 and PW-2 results to estimate risks from soil and groundwater, respectively			
Future Land Use										
Willow Woods Property	7×10^{-5}	--	--	--	--	0.5	--	--	--	No
Matteo Property	**6×10^{-3}**	§ cPAHs in SS (4×10^{-3}) § Aroclor 1260 in SS (2×10^{-4}) § Vinyl Chloride in GW (4×10^{-4}) § Arsenic in GW (6×10^{-4}) § cPAHs in SW (8×10^{-4}) § PCBs in fish (3×10^{-4}) □ Aroclor 1248 (5×10^{-5}) □ Aroclor 1254 (1×10^{-4}) □ Aroclor 1260 (9×10^{-5})	61% 3% 7% 10% 13% 4%	**2×10^{-3}**	§ cPAHs in SS (2×10^{-3}) § Arsenic in GW (1×10^{-4}) § Vinyl Chloride in GW (1×10^{-4}) § Arsenic in GW (1×10^{-4}) § cPAHs in SW (3×10^{-4})	**94**	§ HI Blood: 16 (antimony in GW) § HI Liver: 3 (individual chemicals HIs < 1) § HI Kidney: 15 (vanadium in SS, GW, and SED) § HI Respiratory: 6 (vanadium in SS) § HI Eye: 50 (Aroclor 1260 in SS and Aroclors 1254 and 1260 in fish) § HI Longevity: 15 (antimony in GW) § HI Skin: 6 (arsenic in GW) § HI Immune System: 51 (Aroclor 1260 in SS and Aroclors 1254 and 1260 in fish) § HI GI Tract: 3 (iron in GW) § HI Finger Nail: 50 (Aroclor 1260 in SS and Aroclors 1254 and 1260 in fish)	**30**	§ HI Blood: 5 (antimony in GW) § HI Liver: 1 § HI Kidney: 5 (vanadium in SS, GW, and SED) § HI Respiratory: 3 (vanadium in SS) § HI Eye: 16 (Aroclor 1260 in SS and Aroclors 1254 and 1260 in fish) § HI Longevity: 4 (antimony in GW) § HI Skin: 2 (arsenic in GW) § HI Immune System: 16 (Aroclor 1260 in SS and Aroclors 1254 and 1260 in fish) § HI GI Tract: 1 § HI Finger Nail: 16 (Aroclor 1260 in SS and Aroclors 1254 and 1260 in fish)	**Yes** (in SS, GW, SW, and fish)

Table 1-2
Summary of Cancer Risks and Noncancer Health Hazards for Residents
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Receptor	Cancer Risk[1]					Noncancer Hazard Index[2]				Risk from Lead[3]
	Reasonable Maximum Exposure			Central Tendency Exposure		Reasonable Maximum Exposure		Central Tendency Exposure		
	Total	Major Risk Driver[4]	Percent of Total Risk	Total	Major Risk Driver	Total	Organ/Effect (Major Risk Driver)[4]	Total	Organ/Effect (Major Risk Driver)	Adverse Health Effect? (Yes or No)
Matteo Property - continued	**2×10^{-3}**	Total risk excluding soil outlier				**60**	Total risk excluding soil outlier			
		§ cPAHs in SS (3×10^{-5})	2%				§ HI Blood: 16 (antimony in GW)			
		§ Aroclor 1260 in SS (2×10^{-6})	0.1%				§ HI Liver: 0.8			
		§ Vinyl Chloride in GW (4×10^{-4})	19%				§ HI Kidney: 15 (vanadium in SS, GW, and SED)			
		§ Arsenic in GW (6×10^{-4})	27%				§ HI Respiratory: 6 (vanadium in SS)			
		§ cPAHs in SW (8×10^{-4})	36%				§ HI Eye: 18 (Aroclors 1254 and 1260 in fish)			
		§ PCBs in fish (3×10^{-4})	12%				§ HI Longevity: 15 (antimony in GW)			
		□ Aroclor 1248 (5×10^{-5})					§ HI Skin: 6 (arsenic in GW)			
		□ Aroclor 1254 (1×10^{-4})					§ HI Immune System: 18 (Aroclors 1254 and 1260 in fish)			
		□ Aroclor 1260 (9×10^{-5})					§ HI GI Tract: 3 (iron in GW)			
							§ HI Finger Nail: 18 (Aroclors 1254 and 1260 in fish)			

cPAHs = carcinogenic polyaromatic hydrocarbons   SED = sediment   SW = surface water   GI = gastrointestinal
PCBs = polychlorinated biphenyls   GW = groundwater   SS = surface soil

(1) Bolded values exceed EPA's target range of 1 in 1,000,000 to 1 in 10,000.
(2) Bolded values exceed EPA's threshold of unity (1).
(3) Lead concentration exceeds one or more of the following screening criteria:
EPA Regional Screening Level (RSL) for residential soil: 400 milligram per kilogram (mg/kg)
EPA RSL for industrial soil: 800 mg/kg
New Jersey Groundwater Quality Standards for Class IIA Water: 5 micrograms per liter (µg/L)
New Jersey Surface Water Quality Criteria for Fresh Water(Human Health): 5 µg/L
EPA Region 2 Screening Level for Fish: 0.1 mg/kg
(4) Major risk drivers include those chemicals that contribute more than 10% of the total cancer risk or cancer risk greater than 10^4 or have an HI greater than 1.
Only PCBs, antimony, and lead are considered to be site-related chemicals.
(5) For residents, cancer risk is based on age-adjusted scenario and noncancer hazard index is based on child exposure scenario.
(6) The residential property P002 is not included in this assessment. A human health risk evaluation for only lead was performed for P002, and is detailed in the Remedial Investigation Addendum (CDM Smith 2019)

Table 2-1
Chemical-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Feasibility Study Consideration
Federal	EPA Regional Screening Level (RSL) for residential soil	Establishes risk-based screening levels for soil cleanups for the protection of human health and the environment.	The RSL will be considered in the development of the PRGs if there are no applicable standards.
Federal	National Primary Drinking Water Standards (40 C.F.R. Part 141 [Maximum contaminant levels for organic contaminants] and 40 C.F.R. Part 142 [Maximum contaminants levels for inorganic contaminants])	Establishes drinking water standards (Maximum Contaminant Levels [MCLs]). Groundwater at the Site is currently not used as a source of drinking water.	The standards will be considered in developing the PRGs to accommodate any future use of Site groundwater as a drinking water source.
Federal	TSCA (40 C.F.R. Part 761.61)	Provides soil cleanup levels for low/high occupancy areas.	The cleanup levels will be considered to develop the PRGs for the Site.
Federal	EPA Memorandum "Updated Scientific Consideration for Lead in Soil Cleanups" (OLEM Direction 9200.2-167) (December 22, 2016)	Guidance on development of residential lead cleanup criterion for Superfund sites using Integrated Exposure Uptake and Biokinetic models and current scientific conclusions to determine soil screening levels (such as 10 micrograms per deciliter [µg/dL] blood lead level for children).	The memorandum will be considered in development of the cleanup level and the design of remediation at the residential properties
State	New Jersey Residential Direct Contact and Non-Residential Direct Contact Soil Remediation Standards (N.J.A.C. 7:26D-4)	Establishes standards for soil cleanups.	The standards will be considered in developing the PRGs.
State	NJDEP Guidance Document for Development of Impact to Groundwater Soil Remediation Standards, November 2013	Guidance on determining site-specific impact to groundwater soil remediation standards.	The criteria will be considered in developing the PRGs.
State	New Jersey Ground Water Quality Standards (N.J.A.C. 7:9C)	Establishes the water quality standards for the State's groundwater cleanups based on the type of groundwater use. Groundwater at the Site is classified as Class IIA, suitable for drinking water use.	The standards will be used to develop the PRGs.
State	New Jersey Drinking Water Quality Standards (N.J.A.C. 7:10)	Establishes drinking water standards (MCLs) for the State.	The standards will be used to develop the PRGs to accommodate any future use of Site groundwater as a drinking water source.
State	New Jersey Surface Water Quality Standards (N.J.A.C. 7:9B)	Establishes water quality standards for the protection and enhancement of surface water bodies, including those at the Site (Hessian Run and Woodbury Creek).	The standards will be used to develop the PRGs.

Acronyms:

ARAR - Applicable or Relevant and Appropriate Requirement
C.F.R. - Code of Federal Regulations
EPA - United States Environmental Protection Agency
MCL - Maximum Contaminant Level
OLEM - Office of Land and Emergency Management
N.J.A.C. - New Jersey Administrative Code
PRG - Preliminary Remediation Goal
RSL - Regional Screening Level
TBC - Advisories, Criteria, and Guidance To Be Considered
TSCA - Toxic Substances Control Act
µg/dL - micrograms per deciliter

Table 2-2
Location-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
Coastal Zone Regulations			
Federal	Section 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. § 403, 33 C.F.R. Part 322	Governs coordination with the U.S. Army Corps of Engineers with regard to work at or below mean high water, including dredging, discharging dredged or fill materials at Hessian Run and wetland areas.	On-site activities would be properly conducted to minimize adverse effects.
Federal	Coastal Zone Management Act (CZMA) (16 U.S.C.§ 1451, et seq.) Coastal Zone Management Act (Federal Consistency Regulations, 15 C.F.R. Part 930)	This act encourages states to develop coastal management plans to manage competing uses of and impacts to coastal resources, and to manage sources of nonpoint source pollution in coastal waters. The CZMA Federal Consistency Determination provisions require that any federal agency undertaking a project in the coastal zone of a state shall insure that the project is, to the maximum extent practicable, consistent with the enforceable policies of approved state management programs. Implemented through compliance with substantive requirements of New Jersey Waterfront Development Law and Coastal Zone Management Rules, N.J.A.C. 7:7.	This requirement will be considered during the development of alternatives.
State	Coastal Zone Management Rules (N.J.A.C. 7:7E)	This program establishes standards for use and development of coastal resources.	Remedy will be consistent, to the extent practicable, with these regulations.
Wetlands and Floodplains Standards and Regulations			
Federal	Statement of Procedures on Floodplain Management and Wetlands Protection (40 C.F.R. Part 6, Appendix A)	This Statement of Procedures sets forth Agency policy and guidance for carrying out the provisions of EO 11988 and EO 11990.	This requirement will be considered during the development of alternatives to ensure floodplain management and wetland protection. Wetland and floodplain assessments will be performed as part of the remedy.
Federal	Policy on Floodplains and Wetlands Assessments for CERCLA Actions (OSWER Directive 9280.0-02, 1985)	Superfund actions must meet the substantive requirements of EO 11988, EO 11990, and 40 C.F.R. Part 6, Appendix A. This memorandum discusses situations that require preparation of a floodplains or wetlands assessment, and the factors that should be considered in preparing an assessment, for response actions taken pursuant to Section 104 or106 of CERCLA. For remedial actions, a floodplain/ wetlands assessment must be incorporated into the analysis conducted during the planning of the remedial action.	This requirement will be considered during the development of alternatives to ensure floodplain management and wetland protection. Wetland and floodplain assessments will be performed as part of the remedy.

Table 2-2
Location-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
Federal	Floodplain Management (Executive Order 11988, as amended by Executive Order 13690)	Federal agencies are required to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	The potential effects of any action will be evaluated to ensure that the planning and decision making reflect consideration of flood hazards and floodplains management, including restoration and preservation of natural undeveloped floodplains. A floodplain assessment will be performed as part of the remedy.
Federal	Protection of Wetlands (Executive Order 11990)	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.	Remedial alternatives that involve construction must include all practicable means of minimizing harm to wetlands. Wetlands protection considerations must be incorporated into the planning and decision making of remedial alternatives. A wetland assessment will be performed as part of the remedy.
State	New Jersey Freshwater Wetlands Protection Act Rules (N.J.S.A.13:981, N.J.A.C. 7:7A)	Regulates construction or other activities (including remedial action) that will have an impact on wetlands.	Best management practices will be used to avoid or minimize adverse impact to aquatic habitat, consistent with substantive requirements of N.J.A.C. 7:7A.
State	New Jersey Flood Area Control Act Rules (N.J.A.C.7:13)	Regulates activities (including remedial action) within flood hazard areas that will impact stream carrying capacity or flow velocity to avoid increasing impacts of flood waters, to minimize degradation of water quality, protect wildlife and fisheries, and protect and enhance public health and welfare.	This requirement will be met during the development of alternatives. A floodplain assessment will be performed as part of the remedy. In addition, any disturbance to the stream or riparian zone that occurs as part of the remedy will be restored.
Wildlife Habitat Protection Standards and Regulations			
Federal	Fish and Wildlife Coordination Act, 16 U.S.C. § 661-666c	Requires consideration of the effects of a proposed action on wetlands and areas affecting streams (including floodplains), as well as other protected habitats. Calls for federal agencies to consult with the United States Fish and Wildlife Service (USFWS) and the appropriate state agency with jurisdiction over wildlife resources prior to issuing permits or undertaking actions involving the modification of any body of water (including impoundment, diversion, deepening, or otherwise controlled or modified for any purpose).	EPA will consult with USFS and the state.
Federal	Migratory Bird Treaty Act (16 U.S.C. 703 et seq.)	Prohibits the taking of protected migratory bird species, including individual birds or their nests or eggs, unless otherwise permitted.	Will be considered during the development of alternatives.

Table 2-2
Location-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
Federal	Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1801, et seq.	Requires that federal agencies consult with NMFS on actions that may adversely affect essential fish habitat (EFH), defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."	The remedy will comply with substantive requirements of the Act. If there are no substantial impacts to EFH from the selected remedy, an EFH worksheet may need to be completed and submitted during the design or remedial action phase. However, if there are potential significant impacts to EFH from remedial action, an EFH assessment will need to be prepared.
Historic Preservation Standards and Regulations			
Federal	National Historic Preservation Act, 54 U.S.C. § 300101, *et seq.,* 36 C.F.R. Part 800	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	The effects of remedial actions on historical and archeological data will be considered during the remedial design.

Acronyms:

ARAR - Applicable or Relevant and Appropriate Requirement
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R. - Code of Federal Regulations
CZMA - Coastal Zone Management Act
EO - Executive Order
EFH - Essential Fish Habitat
EPA - United States Environmental Protection Agency
N.J.A.C. - New Jersey Administrative Code
N.J.S.A. - New Jersey Statutes Annotated
OSWER - Office of Solid Waste and Emergency Response
TBC - Advisories, Criteria, and Guidance To Be Considered
U.S.C. - United States Code
USFWS - United States Fish and Wildlife Service

Table 2-3
Action-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
General Site Remediation			
Federal	RCRA Identification and Listing of Hazardous Waste (40 C.F.R. Part 261.3 and 261.10)	Describes methods for identifying hazardous wastes and lists known hazardous wastes.	Applicable to the identification of hazardous wastes that are generated, treated, stored, or disposed of during remedial activities.
Federal	RCRA Standards Applicable to Generators of Hazardous Waste (40 C.F.R. Part 262)	Standards applicable to generators of hazardous wastes.	These standards will be followed if any hazardous wastes are generated onsite.
Federal	RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities – General Facility Standards (40 C.F.R. Part 264, Subpart B)	General hazardous waste facility requirements, including waste analysis, security measures, inspections, and training requirements.	Facilities involved in the remedial activities will be designed, constructed, and operated in accordance with Part 264. All workers will be properly trained.
Federal	RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities – Preparedness and Prevention (40 C.F.R. Part 264, Subpart C [Preparedness and Prevention])	This regulation outlines the requirements for safety equipment, spill control, and arrangements with local authorities at hazardous waste facilities.	Safety and communication equipment will be installed at the site. Local authorities will be familiarized with the site.
Federal	RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities – Contingency Plan and Emergency Procedures (40 C.F.R. Part 264, Subpart D)	Requirements for emergency procedures to be used following explosions, fires, etc. at hazardous waste facilities.	Emergency Procedure Plans will be developed and implemented during remedial action. Copies of the plans will be kept onsite.
State	New Jersey Technical Requirements for Site Remediation (N.J.A.C. 7:26E)	Provides technical requirements to investigate and remediate contamination at the Site.	The regulation will be applied to any hazardous waste operation during remediation of the site.
State	New Jersey Uniform Construction Code (N.J.A.C. 5:23)	Requirements for construction performed during remediation of the Site.	This code will be applied to any construction performed during remediation of the site.
State	New Jersey Hazardous Waste Regulations - Identification and Listing of Hazardous Waste (N.J.A.C. 7:26G-5)	Methods for identifying hazardous wastes and lists known hazardous wastes.	This regulation will be applicable to the identification of hazardous wastes that are generated, treated, stored, or disposed of during remedial activities.
State	New Jersey Stormwater Management Rule (N.J.A.C. 7:8)	This regulation sets the requirements for stormwater management during construction including nonstructural stormwater management strategies, erosion control, and stormwater runoff quality standards.	Substantive requirements will be met during construction.

Table 2-3
Action-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
State	New Jersey Soil Erosion and Sediment Control Act (N.J.A.C. 2:90, N.J.S.A. 4:24-39, et seq.)	Regulates construction that will potentially result in erosion of soil and sediment. Lists requirements including the submittal and approval of a plan for soil erosion and sediment control.	This act will be considered during the development of alternatives.
State	New Jersey Noise Control (N.J.A.C. 7:29)	Regulates noise levels for certain types of activities such as commercial, industrial, community service and public service facilities. Relevant and appropriate for establishing allowable noise levels.	This standard will be applied to remediation activities performed at the Site.
Transportation of Contaminated Materials			
Federal	Hazardous Material Transportation Act, 49 U.S.C. § 1801-1819, Department of Transportation Rules for Transportation of Hazardous Materials (49 C.F.R. Part 107, 171, 172, 177-179)	Applicable to the transportation of excavated material that is being managed as hazardous waste. Includes requirements for the packaging, labeling, manifesting, and transporting hazardous materials.	Any company contracted to transport hazardous material from the Site will be required to comply with this regulation.
Federal	RCRA Standards Applicable to Transporters of Hazardous Waste (40 C.F.R. Part 263)	This regulation establishes standards for hazardous waste transporters.	Any company contracted to transport hazardous material from the Site will be required to comply with this regulation.
Federal	TSCA-PCB Waste Disposal Records and Reports (40 C.F.R. Part 761, Subpart K)	This regulation establishes the responsibility of generators, transporters, and disposers of PCB waste in the handling, transportation, and management of the waste. Requires a manifest and record-keeping.	Applicable to the transportation of hazardous material from the Site.
State	New Jersey Transportation of Hazardous Materials (N.J.A.C. 16:49)	Regulates the shipping, packaging, marking, labeling, placarding, handling, and transportation of hazardous materials.	Applicable to the transport of hazardous material from the Site.
Excavation and In Situ Treatment (e.g. Stabilization/Solidification)			
Federal	Clean Air Act - National Ambient Air Quality Standards (40 C.F.R. Part 50)	This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter. Fugitive dust emissions from site excavation activities must be maintained below 260 $\mu g/m^3$ (primary standard).	Proper dust suppression methods such as water spray would be specified when implementing excavation and/or solidification/stabilization actions.
Federal	40 C.F.R. Part 264, Subpart L	Provides requirements to design and operate waste piles including controlling wind dispersal of particulate matter and controlling surface water from running through the piles.	Performance standards would be specified for compliance.

Table 2-3
Action-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
Federal	Section 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. § 403, C.F.R. Part 322	Governs coordinate with the U.S. Army Corps of Engineers with regard to work at or below mean high water, including dredging, discharging dredged or fill materials at Hessian Run and wetlands areas.	U.S. Army Corps of Engineers approval is generally required to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of any navigable water of the United States. On-site work for CERCLA remedies is exempt from permit requirements under CERCLA Section 121(e), although the work will comply with substantive requirements of these regulations and will be coordinated with the U.S. Army Corps of Engineers.
Federal	Clean Water Act, Section 404, 33 U.S.C. § 1344, C.F.R. Part 230 (Section 404(b)(1) (Guidelines for Specification of Disposal Sites for Dredged or Fill Material)	Regulated the discharge of dredged and fill material into waters of the United States including wetlands.	On-site activities would be properly conducted to minimize adverse effects.
Disposal of Contaminated Materials			
Federal	RCRA Land Disposal Restrictions (LDRs) (40 C.F.R. Part 268)	Identifies hazardous wastes restricted for land disposal and provides treatment standards for land disposal.	Hazardous wastes will be treated to meet disposal requirements.
Federal	Area of Contamination Policy (55 FR 8758-8760, March 8, 1990)	This policy addresses consolidation of contiguous waste within an area of contamination (AOC). Movement of media contaminated with hazardous wastes within an AOC does not typically trigger RCRA requirements.	Hazardous wastes may be consolidated and contained within an AOC without triggering LDRs or other treatment, storage, or disposal requirements under RCRA.
Federal	Corrective Action Management Units (40 C.F.R. § 264.552)	These regulations provide exceptions to LDR requirements and establish rules for consolidation and treatment of noncontiguous waste within the Site.	Hazardous wastes will be treated and backfilled onsite using the CAMU for one of the proposed alternatives.
Federal	TSCA Disposal Requirements (40 C.F.R. Part 268, Subpart D - Treatment Standards)	Soils contaminated above 50 ppm may also be disposed of in a chemical waste landfill.	Alternative development will incorporate disposal requirements.
State	New Jersey Land Disposal Restrictions (LDRs) (N.J.A.C. 7:26G-11)	These regulations established standards for treatment and disposal of hazardous wastes.	Hazardous wastes must comply with the treatment and disposal standards.

Table 2-3
Action-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
Discharge to Surface Water or Groundwater			
Federal	National Pollutant Discharge Elimination System (NPDES) (40 C.F.R. 122 et seq.)	NPDES permit requirements for point source discharges must be met, including the NPDES Best Management Practice Program. These regulations include, but are not limited to, requirements for compliance with water quality standards, a discharge monitoring system, and records maintenance.	The project will meet substantive NPDES permit requirements for point source discharges.
Federal	Clean Water Act Section 404 (33 C.F.R. Parts 320-323, 40 C.F.R. Parts 230-233)	This requirement restricts discharge of dredged or fill material to wetlands or waters of the United States and provides a permitting program for situations with no other practical alternative.	The remedy will incorporate these requirements
Federal	Ambient Water Quality Criteria (40 C.F.R. § 131.36)	This regulation establishes toxics criteria for those states not complying with Clean Water Act Section 303(c)(2)(B).	The criteria will be considered during the evaluation of discharge practices during the remedial action.
Federal	Effluent Guidelines and Standards for the Point Source Category (40 C.F.R. Part 414)	These regulations establish effluent limitations organized by industry on direct discharge and indirect discharge point sources.	Point source discharges will comply with these standards.
State	The New Jersey Pollutant Discharge Elimination System (NJPDES) (N.J.A.C. 7:14A)	Governs the discharge of any wastes into or adjacent to State waters that may alter the physical, chemical, or biological properties of State waters.	The project will meet substantive NJPDES permit requirements for any surface water discharges or groundwater discharges, such as injection of reagent for in situ treatment.
Off-Gas Management			
Federal	Clean Air Act - National Ambient Air Quality Standards (40 C.F.R. Part 50)	This regulation provides air quality standards for particulate matter, lead, NO_2, SO_2, CO, and volatile organic matter.	During excavation, treatment, and/or stabilization of waste, air emissions will be properly controlled and monitored to comply with these standards.
Federal	Standards of Performance for New Stationary Sources (40 C.F.R. Part 60)	This regulation sets the general requirements for air quality for new stationary sources of air pollution.	During excavation, treatment, and/or stabilization of waste, air emissions will be properly controlled and monitored to comply with these standards.
Federal	National Emission Standards for Hazardous Air Pollutants (40 C.F.R. Part 61)	This regulation provides air quality standards for hazardous air pollutants.	During excavation, treatment, and/or stabilization of waste, air emissions will be properly controlled and monitored to comply with these standards.

Table 2-3
Action-Specific ARARs and TBCs
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Regulatory Level	ARAR/TBC	Requirement Synopsis	Required Action
State	New Jersey Air Pollution Control Act (N.J.A.C. 7:27)	This regulation includes rules that govern the emission of contaminants into the ambient atmosphere.	This standard will be applied to air emissions from remediation activities performed at the Site.
State	New Jersey Ambient Air Quality Standards (N.J.A.C. 7:27-13)	This standard provides the requirements for ambient air quality control.	This standard would apply to air emissions from remediation activities performed at the Site.

Acronyms:

AOC - area of contamination
ARAR - Applicable or Relevant and Appropriate Requirement
C.F.R. - Code of Federal Regulations
CO - Carbon monoxide
EPA - United States Environmental Protection Agency
FR - Federal Register
LDR - Land Disposal Restrictions
N.J.A.C. - New Jersey Administrative Code
N.J.S.A. - New Jersey Statutes Annotated
NJPDES - New Jersey Pollutant Discharge Elimination System
NO_2 - Nitrogen dioxide
NPDES - National Pollutant Discharge Elimination System
OSHA - Occupational Safety and Health Administration
OSWER - Office of Solid Waste and Emergency Response
RCRA - Resource Conservation and Recovery Act
SO_2 - Sulfur dioxide
TBC - Advisories, Criteria, and Guidance To Be Considered
TSCA - Toxic Substances Control Act

Table 2-4a
Preliminary Remediation Goals - Soil
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Chemical Name	Unit	NJDEP Non-Residential Direct Contact Soil Remediation Standards (1)	NJDEP Residential Direct Contact Soil Remediation Standards (1)	NJDEP Default Impact to Groundwater Soil Remediation Standards (2)	Remediation Goal Based on Food Chain Modeling (3)	Background Values (4) (5)	EPA Toxic Substances Control Act (TSCA) High Occupancy Area (HOA) Cleanup Level (ppm)(6)		EPA Toxic Substances Control Act (TSCA) Low Occupancy Area (HOA) Cleanup Level (ppm)(6)			Non-Residential Preliminary Remediation Goals (7)	Residential Preliminary Remediation Goals (8)	Ecological Preliminary Remediation Goals (9)	Maximum Concentrations Observed during RI 2015
							Unrestricted Use	Cap and Deed Notice	Unrestricted Use	Fenced and Signage	Cap and Deed Notice				
Polychlorinated Biphenyls (PCBs)															
PCBs	mg/kg	1	0.20	0.20	NA	NA	≤1	>1 - ≤10	≤25	>25 - ≤50	>25 - ≤100	1	0.20	NA	540
Inorganics															
Antimony	mg/kg	450	31	6	NA	NL	NA	NA	NA	NA	NA	450	31	NA	465
Lead	mg/kg	800	400	90	55	128	NA	NA	NA	NA	NA	800	400; with average < 200	128	94,100
Zinc	mg/kg	110,000	23,000	600	62	106	NA	NA	NA	NA	NA	NA	NA	106	13,400

Notes:

(1) NJDEP 2012. Non-Residential Direct Contact Health-Based Criteria and Soil Remediation Standards. Last amended May 7, 2012; http://www.state.nj.us/dep/srp/regs/rs/

(1) NJDEP 2012. Residential Direct Contact Health-Based Criteria and Soil Remediation Standards. Last Amended May 7, 2012; http://www.state.nj.us/dep/srp/regs/rs/

(2) NJDEP 2008. Guidance Document, Development of Site-Specific Impact to Groundwater Soil Remediation Standards Using the Soil-Water Partition Equation, Version 2.0. November 2013; http://www.nj.gov/dep/srp/guidance/rs/igw_intro.htm Downloaded April 20, 2015.

(3) Ecological remediation goals calculated based on the Step 3a food chain model.

(4) Background of lead --- Background values based on the 95 percent UCL of background concentration results from OU2.

(5) Background of zinc --- NJDEP 2003. Ambient Levels of Metals in New Jersey Soils (May 2003); http://www.state.nj.us/dep/dsr/research/ambient-levels-metal.pdf. Background values based on the 90th percentile concentrations from the Urban Coastal Plain.

(6) Toxic Substances Control Act (TSCA) (40 CFR Part 761.61 - PCB remediation waste). Last amended June 25, 2009.

(7) NJDEP Non-Residential Direct Contact Soil Remediation Standards are applicable requirements and were selected as the preliminary remediation goals for the Open Field/Waste Disposal, the Scrapyard Area, and Mira Trucking. In addition, for lead, based on the ecological risk assessment and site-specific background level developed in Operable Unit 2, 128 mg/kg is selected as the PRG for lead in surface soil (0 to1 feet below ground surface)

(8) NJDEP Residential Direct Contact Soil Remediation Standards are applicable requirements and were selected as the preliminary remediation goals for the Rental Home area and Willow Woods property. In addition, to comply with the EPA 2016 policy for lead cleanup and EPA region 2 policy, after remediation is performed, the average lead concentration at the residential property should be less than 200 mg/kg.

(9) Ecological receptors have been identified in the open field/waste disposal area. Based on the ecological risk assessment and site-specific background level, an ecological PRG of 128 mg/kg is selected for lead in surface soil (0 to 1 foot below ground surface).

Highlighted PRGs will drive site remediation.

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
CAS No. = Chemical Abstracts Service number
NA = not applicable
NJDEP = New Jersey Department of Environmental Protection
NL = not listed
NR = not a risk driver

Table 2-4b
Preliminary Remediation Goals - Groundwater
Matteo & Sons, Inc. Site
Thorofare, New Jersey

CAS No.	Chemical Name	Unit	National Primary Drinking Water Standards (EPA MCLs) (1)	NJ Groundwater Quality Standards (2)	NJ Drinking Water Standards (3)	Preliminary Remediation Goals (4)
Polychlorinated Biphenyls						
1336-36-3	Polychlorinated Biphenyls	µg/L	0.5	0.5	0.5	0.5
Inorganics						
7440-36-0	Antimony	µg/L	6	6	6	6
7439-92-1	Lead	µg/L	15	5	15	5
7440-66-6	Zinc	µg/L	NL	2,000	5,000	2,000

Notes:
(1) EPA 2009. National Primary Drinking Water Standards (EPA 816-F-09-004, May 2009); http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf.
(2) NJDEP 2010. New Jersey Ground Water Quality Standards Class IIA (N.J.A.C. 7:9C, July 22, 2010, readopted without change on March 4,2014); http://www.nj.gov/dep/wms/bwqsa/njac79C.pdf.
(3) NJDEP 2009. New Jersey Drinking Water Standards (February 10, 2009); http://www.nj.gov/dep/standards/drinking%20water.pdf.
(4) NJ Groundwater Quality Standards are the lowest of the available standards and were selected as the Preliminary Remediation Goals.

Highlighted PRGs were exceeded and will drive site remediation.
µg/L = micrograms per liter
CAS No. = Chemical Abstracts Service number
EPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
NJ = New Jersey
N.J.A.C. = New Jersey Administrative Code
NJDEP = New Jersey Department of Environmental Protection
NL = not listed

Table 2-5
Contaminated Volumes
Matteo & Sons, Inc. Site
Thorofare, New Jersey

Media	Chemical Name	PRG	Depth Interval (feet bgs)	Depth (feet)	Area (square feet)	Volume (cubic yards)
Source Materials						
Battery Casings						**19,400**
Mixed Battery Casings and Waste						**19,100**
Highly Contaminated Soil Beneath Battery Casings mixed with municipal wastes and soil (1 foot)						**9,100**
Sediment mixed with battery casings						**8,600**
Total Source Materials						**56,000**
Soil						
Scrapyard Area						
Surface Soil	Lead	Commercial	0 - 2	2	153,628	11,380
	Polychlorinated Biphenyls		0 - 2	2	68,246	5,055
	Total (w/overlap)		0 - 2	2	181,657	**13,456**
Subsurface Soil	Lead		2 - 4	2	13,533	1,002
	Polychlorinated Biphenyls		2 - 4	2	17,214	1,275
	Total (w/overlap)		2 - 4	2	17,214	**1,275**
Surface Area	**Total surface area of contamination**		0 - 4	--	181,657	--
	Lead and PCB contaminated soils					**12,382**
	PCB (only) contaminated Soils					**2,349**
Open Field/Waste Disposal Area						
Surface Soil	Lead (above Ecological PRG, but lower than Commercial)	Ecological	0 - 1	1	246,650	9,135
	Lead (only above Commercial)	Commercial	0 - 2	2	74,863	5,545
	Polychlorinated Biphenyls		0 - 2	2	194,757	14,426
	Total (w/overlap)		0 - 2	2	240,348	**17,810**
Subsurface Soil	Lead (only above Commercial)	Commercial	2 - 4	2	13,647	1,011
	Polychlorinated Biphenyls		2 - 4	2	39,395	2,918
	Total (w/overlap)		2 - 4	2	53,042	**3,929**
	Lead (only above Commercial)	Commercial	4 - 8	4	3,403	504
	Polychlorinated Biphenyls		4 - 8	4	5,652	837
	Total (w/overlap)		4 - 8	4	9,055	**1,341**
	Lead soils above Ecological PRG					**9,135**
	Lead and PCB contaminated soils					**7,060**
	PCB (only) contaminated Soils					**6,885**
Rental Home Area						
Surface Soil	Lead	Residential	0 - 2	2	**18,005**	**1,334**
Mira Trucking/Residential Property P002 (Source Materials and Soil)						
Surface Soil	Lead	Commercial	0 - 1	1	**151,549**	5,613
Subsurface Soil	Lead		1 - 2	1	**100,066**	3,706
Suburface Soil	Lead		2 - 4	2	**25,856**	1,915
	Mira Trucking Lead contaminated soils					**11,234**

Notes:
PRG - preliminary remediation goal
bgs - below ground surface
w/ - with
PCB - polychlorinated biphenyl

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Table 2-6 Technology Screening Summary

General Response Action	Technology Types	Process Options
NO ACTION	None	
INSTITUTIONAL CONTROLS	Institutional Controls	Deed Notice
		Fencing and Warning Signs
		Community Awareness
		Inspection and Maintenance Program
MONITORING	Monitoring	Long-Term Monitoring
MONITORED NATURAL ATTENUATION/ RECOVERY	Monitored Natural Attenuation/Recovery	Monitored Natural Attenuation
		Monitored Natural Recovery
CONTAINMENT	Containment	Engineered Containment Structure
		Capping of Soil
REMOVAL	Removal	Excavation
		Dredging
		Dewatering
TREATMENT	In Situ Treatment	In situ Stabilization
		In situ Solidifcation
	Ex Situ Treatment	Ex situ Stabilization
		Ex situ Solidifcation
DISPOSAL	Offsite Disposal	Offsite disposal at a non-hazardous waste (RCRA Subtitle D) landfill
		Offsite disposal at a hazardous waste (RCRA Subtitle C) landfill

Gray shading indicates technology was screened out.

Table 3-1
Matrix of Alternatives
Matteo & Sons, Inc. Site
Thorofare, NJ

<table>
<tr><th>Site Area</th><th>Description of Contaminated Materials</th><th>PRGs Applied to Area</th><th>Volume of Contaminated Materials (cubic yard)</th><th><u>Alternative 2</u>
Excavation, Stabilization, On-site Containment, and Capping</th><th><u>Alternative 3</u>
Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping</th><th><u>Alternative 4</u>
Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping</th><th><u>Alternative 5</u>
Excavation and Off-site Disposal</th></tr>
<tr><td rowspan="3">Source Materials – Battery Casings/ Sediment or Waste Mixed with Battery Casings</td><td>Sediments mixed with Battery Casings along the shoreline with lead contamination</td><td>--</td><td>8,600</td><td rowspan="3">Excavated and contained onsite above the 100-year flood zone, and inspection/maintenance</td><td rowspan="3">Excavated and disposed of offsite</td><td rowspan="7">Excavated and disposed of offsite</td><td rowspan="9">All contaminated materials would be excavated and disposed of offsite</td></tr>
<tr><td>Battery Casings and Waste Mixed with Battery Casings</td><td>--</td><td>38,500</td></tr>
<tr><td>Soil beneath Battery Casings and Battery Casing Mixed Waste [1]</td><td>--</td><td>9,100</td></tr>
<tr><td rowspan="3">Open Field/ Waste Disposal Area</td><td>Open Field/Waste Disposal Area Soils with Lead Contamination above Commercial PRG</td><td>Commercial PRG</td><td>7,100</td><td colspan="2">Excavated, stabilized ex situ, placed over the PCB-contaminated soils and capped with erosion controls, and inspection/maintenance</td></tr>
<tr><td>Open Field/Waste Disposal Area Soils with Lead Contamination above Ecological PRG</td><td>Ecological PRG for Lead, less than Commercial PRG for Lead</td><td>9,200</td><td colspan="2">Capped with clean fill and inspection/maintenance</td></tr>
<tr><td>Open field/waste disposal area soils with only PCB contamination</td><td>Commercial PRG for PCBs</td><td>6,900</td><td colspan="2">Covered with stabilized materials, clean fill, and capped with erosion controls, and inspection/maintenance</td></tr>
<tr><td>Residential Areas</td><td>Lead-contaminated soils at the Rental Home Area</td><td>Residential PRG</td><td>1,350</td><td colspan="2">Excavated, stabilized ex situ, placed over the PCB-contaminated soils and capped with clean fill and erosion controls</td></tr>
<tr><td rowspan="2">Scrapyard Area</td><td>Scrapyard Soils with lead contamination</td><td>Commercial PRG</td><td>12,400</td><td colspan="3" rowspan="2">Cap in place and inspection/maintenance</td></tr>
<tr><td>Scrapyard Soils with only PCB contamination</td><td>Commercial PRG</td><td>2,400</td></tr>
<tr><td>Mira Trucking</td><td>Soils with lead contamination on property located on opposite side of the road from the Matteo property and historically used for Matteo site operations</td><td>Commercial PRG</td><td>10,800</td><td colspan="4">Excavate and dispose of offsite</td></tr>
<tr><td>Residential Property P002</td><td>Soils with lead contamination on residential property adjacent to Mira Trucking</td><td>Residential PRG</td><td>400</td><td colspan="4">Excavate and dispose of offsite</td></tr>
<tr><td colspan="4">Common Elements</td><td colspan="4">Excavate source materials, connection to public water, institutional controls, and long-term monitoring for groundwater</td></tr>
</table>

Notes:
1. It is assumed that one foot below the source materials would be native soil.

Table 4-1
Summary of Detailed Analysis of Remedial Action Alternatives
Matteo & Sons, Inc. Site
Thorofare, New Jersey

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Excavation, Stabilization, On-site Containment of Source Materials, and Capping	ALTERNATIVE 3 Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping	ALTERNATIVE 4 Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping	ALTERNATIVE 5 Excavation and Off-site Disposal
Summary of Components	None	▪ Excavation and handling of source materials ▪ On-site containment of source materials ▪ Excavation of contaminated soil exceeding NRDCSRS in the OFWD area ▪ Stabilization of lead-contaminated soils ▪ Excavation of contaminated soil at rental home and Willow Woods ▪ Consolidation of excavated and stabilized soil on top of PCB contamination area ▪ Capping of PCB contamination area and remaining surface contamination area exceeding the ecological PRGs in the OFWD area ▪ Temporary restoration of the shoreline of Hessian Run ▪ Capping of contaminated soil in the scrapyard ▪ Excavation and off-site disposal of source materials and contaminated soil at Mira Trucking ▪ Connection to city water ▪ Inspection and maintenance of the caps ▪ Institutional controls: deed notices for scrapyard, containment cell and cap in OFWD area, and CEA ▪ Long-term monitoring ▪ Site reviews	▪ Excavation and handling of source materials ▪ Off-site disposal of the source materials ▪ Excavation of contaminated soil exceeding NRDCSRS in the OFWD area ▪ Stabilization of lead-contaminated soils ▪ Excavation of contaminated soil at rental home and Willow Woods ▪ Consolidation of excavated and stabilized soil on top of PCB contamination area ▪ Capping of PCB contamination area and remaining surface contamination area exceeding the ecological PRGs in the OFWD area ▪ Temporary restoration of the shoreline of Hessian Run ▪ Capping of contaminated soil in the scrapyard ▪ Excavation and off-site disposal of source materials and contaminated soil at Mira Trucking ▪ Connection to city water ▪ Inspection and maintenance of the caps ▪ Institutional controls: deed notices for scrapyard and cap in OFWD area, and CEA ▪ Long-term monitoring ▪ Site reviews	▪ Excavation of source materials and contaminated soils exceeding PRGs in the OFWD area ▪ Excavation of contaminated soil at rental home and Willow Woods ▪ Off-site disposal of the source materials and excavated soils ▪ Temporary restoration of the shoreline of Hessian Run ▪ Restoration of the OFWD area ▪ Capping of contaminated soil in the scrapyard ▪ Excavation and off-site disposal of source materials and contaminated soil at Mira Trucking ▪ Connection to city water ▪ Inspection and maintenance of the cap at scrapyard ▪ Institutional controls: deed notices for scrapyard, and CEA ▪ Long-term monitoring ▪ Site reviews	▪ Excavation of source materials and contaminated soils exceeding PRGs in the OFWD and scrapyard ▪ Excavation of contaminated soil at rental home and Willow Woods ▪ Off-site disposal of all excavated materials ▪ Temporary restoration of the shoreline of Hessian Run ▪ Restoration of the OFWD area and the scrapyard area ▪ Excavation and off-site disposal of source materials and contaminated soil at Mira Trucking ▪ Connection to city water ▪ Institutional controls: and CEA ▪ Long-term monitoring ▪ Site reviews

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Table 4-1
Summary of Detailed Analysis of Remedial Action Alternatives
Matteo & Sons, Inc. Site
Thorofare, New Jersey

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Excavation, Stabilization, On-site Containment of Source Materials, and Capping	ALTERNATIVE 3 Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping	ALTERNATIVE 4 Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping	ALTERNATIVE 5 Excavation and Off-site Disposal
Overall Protection of Human Health and the Environment	This alternative would not provide protection of human health and the environment since no action would be taken to reduce contaminant mass and to restore the contaminated area. This alternative would not meet the RAOs.	This alternative would provide overall protection of human health and the environment. Exposure pathways would be eliminated or reduced by containment of source materials, stabilization of excavated soils, and capping of contaminated soils. The engineered cell and caps would need to be inspected and maintained regularly and institutional controls would need to be implemented for continuous protection of human health. The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.	This alternative would provide overall protection of human health and the environment. Exposure pathways would be eliminated or reduced by excavation and disposal of source materials and stabilization and capping of contaminated sediment and soil. The cap would need to be inspected and maintained, and institutional controls would need to be implemented for continuous protection. The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.	This alternative would provide overall protection of human health and the environment. Exposure pathways would be eliminated or reduced by the removal and off-site disposal of source materials and contaminated soils and capping of contaminated soil in the scrapyard area. The cap in the scrapyard area would need to be inspected and maintained, and institutional controls would need to be implemented for continuous protection. A deed notice is in place for the scrapyard. The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.	This alternative would provide the highest level of overall protection of human health and the environment. Exposure pathways to human and ecological receptors would be eliminated by removal of source materials and all contaminated soils exceeding the PRGs. The shoreline along Hessian Run would be temporarily restored to minimize erosion. This area would be re-evaluated in OU3.
Compliance with ARARs	Since no action would be taken, this alternative would not meet chemical-specific ARARs. Location- and action-specific ARARs do not apply.	The alternative would meet the PRGs (chemical-specific ARARs) since the source materials and contaminated soils exceeding the PRGs would be removed, contained, stabilized, and capped. Groundwater and surface water would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met. The Superfund AOC rules would allow ex situ treatment and disposal of contaminated materials on-site without meeting the LDR treatment standards.	The alternative would meet the PRGs (chemical-specific ARARs) since the source materials would be removed and disposed off-site; the contaminated soils exceeding the PRGs would be removed, stabilized, and capped. Groundwater and surface water would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met. The CAMU rule would allow ex situ treatment and disposal of contaminated materials on-site without meeting the LDR treatment standards.	The alternative would meet the PRGs (chemical-specific ARARs) since the source materials and contaminated soils (except the scrapyard) would be removed and disposed off-site. The contaminated soils in the scrapyard area would be capped. Groundwater and surface water would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met.	The alternative would meet the PRGs (chemical-specific ARARs) since all the source materials and contaminated soils would be removed and disposed off-site. Groundwater and surface water would be monitored until the PRGs for site-related contaminants are met. Location- and action-specific ARARs would be met.

Table 4-1
Summary of Detailed Analysis of Remedial Action Alternatives
Matteo & Sons, Inc. Site
Thorofare, New Jersey

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Excavation, Stabilization, On-site Containment of Source Materials, and Capping	ALTERNATIVE 3 Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping	ALTERNATIVE 4 Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping	ALTERNATIVE 5 Excavation and Off-site Disposal
Long-term Effectiveness and Permanence	This alternative does not provide long-term effectiveness and permanence since human health and ecological risks from the contaminated media would not be addressed. No measures to monitor the migration of contaminants would be taken.	This alternative would provide long-term effectiveness and permanence. Magnitude of Residual Risk: The magnitude of residual risk is low as source materials would be contained; contaminated soil in OFWD area would be excavated, stabilized ex situ, and capped; and contaminated soil in scrapyard would be capped. Exposure pathways to human and ecological receptors would be eliminated or minimized. Adequacy and Reliability of Controls: The adequacy and reliability of containment cell and soil caps rely on the routine inspection and maintenance and the effective enforcement of institutional controls.	This alternative would provide long-term effectiveness and permanence. Magnitude of Residual Risk: The magnitude of residual risk is minimal as source materials would be removed from the site. The contaminated sediment and lead-contaminated soils in the OFWD area and the residential areas would be excavated, stabilized as necessary, and capped together with contaminated soils in the OFWD area. The contaminated soils in the scrapyard area would also be capped. Exposure pathways to human and ecological receptors would be eliminated or minimized. Adequacy and Reliability of Controls: The adequacy and reliability of the caps rely on the routine inspection and maintenance and the effective enforcement of institutional controls. cell.	This alternative would provide long-term effectiveness and permanence. Magnitude of Residual Risk: The magnitude of residual risk is less than Alternative 3 since the source materials and contaminated soils in areas other than the scrapyard would be excavated and disposed off-site. The contaminated soils in the scrapyard area would be capped to eliminate or minimize pathways to human and ecological receptors. Adequacy and Reliability of Controls: The adequacy and reliability of the asphalt cap at the scrapyard area rely on routine inspection and maintenance of the caps and enforcement of institutional controls. A deed notice is in place for the scrapyard.	This alternative would provide long-term effectiveness and permanence. Magnitude of Residual Risk: There would be no residual risk from contaminated soils at this site since the source materials and contaminated soils above the PRGs would be removed from the site. Adequacy and Reliability of Controls: No control measures would be necessary since all contaminated materials, sediment, and soils would be removed from the site.
Reduction of Toxicity/ Mobility/Volume (T/M/V) through Treatment	The alternative would not reduce contaminant T/M/V.	This alternative would reduce mobility of lead-contaminated soils through stabilization. The toxicity and volume of contamination would not change.	This alternative would reduce the mobility of lead-contaminated soils through stabilization and reduce the mobility of source materials through off-site treatment to meet the universal treatment standards prior to landfill disposal. The toxicity and volume of the lead- and PCB-contaminated soil would not change.	This alternative would reduce the mobility of contaminants in source materials and contaminated soil through off-site treatment to meet the universal treatment standards prior to landfill disposal. The toxicity and volume of contamination from areas other than the scrapyard would be transferred to the landfill. The T/M/V of the contaminated soils at the scrapyard would not change.	This alternative would reduce the mobility of contaminants in source materials and contaminated soil through off-site treatment to meet the universal treatment standards prior to landfill disposal. The T/M/V/ of the contamination would be transferred to the landfills.

Table 4-1
Summary of Detailed Analysis of Remedial Action Alternatives
Matteo & Sons, Inc. Site
Thorofare, New Jersey

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Excavation, Stabilization, On-site Containment of Source Materials, and Capping	ALTERNATIVE 3 Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping	ALTERNATIVE 4 Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping	ALTERNATIVE 5 Excavation and Off-site Disposal
Short-term Effectiveness	Since no action would be implemented at the site, this alternative would not pose a short-term impact to human receptors (such as workers or local residents) or ecological receptors.	This alternative would involve approximately 3 to 3.5 years of operation. It would increase local traffic, generate noise and dust during the day (which would be controlled), and require coordination with existing site operations for construction of the cap at the scrapyard. The on-site containment of source materials above the 100-year flood zone would be approximately 6 feet high, changing the topography of the area. Capping in the OFWD area would raise the topography by approximately 2 feet and would be designed and constructed to prevent impact to the Willow Woods community during storm events.	This alternative would involve approximately 2.5 to 3 years of operation. It would increase local traffic, generate noise and dust during the day (which would be controlled), and require coordination with existing site operations for construction. Capping in the OFWD area would raise the topography by approximately 2 feet and would be designed and constructed to prevent impact to the Willow Woods community during storm events.	This alternative would involve approximately 3 to 3.5 years of operation. It would significantly increase local traffic, generate noise and dust during the day (which would be controlled), and require coordination with existing site operations for construction at the scrapyard.	This alternative would involve approximately 3 to 3.5 years of operation and would significantly increase local traffic due to the commute of construction workers, transportation of large construction equipment, importing of materials, and off-site disposal of all contaminated materials. Construction would generate noise during the day. This alternative would require temporary shutdown of a portion of the existing site operations for excavation of contaminated soils at the scrapyard.
Implementability	This alternative could be implemented immediately since no services or actions would be required.	This alternative is implementable. Equipment and experienced vendors are readily available. Construction of this engineered containment call is technically complex and may raise concerns from the local community. The long-term inspection and maintenance of the cap at the OFWD area might be challenging. EPA and NJDEP would need to develop a plan and provide funding for this activity to ensure continued protection of human health and the environment. Measures for soil erosion controls along Hessian Run are also proven technologies. Temporary restoration of Hessian Run would be designed to account for any future remediation that may be completed as part of OU3.	This alternative is implementable. Equipment and experienced vendors are readily available. The long-term inspection and maintenance of the cap at the OFWD area might be challenging. EPA and NJDEP would need to develop a plan and provide funding for this activity to ensure continued protection of human health and the environment. Measures for soil erosion controls along Hessian Run are also proven technologies. Temporary restoration of Hessian Run would be designed to account for any future remediation that may be completed as part of OU3.	This alternative is implementable. Equipment and experienced vendors are readily available. The long-term inspection and maintenance of the cap at the scrapyard are would be implementable. A deed notice is in place to prevent activities that might compromise the integrity of the remedy. Measures for soil erosion controls along Hessian Run are also proven technologies. Temporary restoration of Hessian Run would be designed to account for any future remediation that may be completed as part of OU3.	This alternative is implementable. Equipment and experienced vendors are readily available. Measures for soil erosion controls along Hessian Run are also proven technologies. Temporary restoration of Hessian Run would be designed to account for any future remediation that may be completed as part of OU3.
Present Worth	There are no capital or O&M costs associated with this alternative.	The present worth cost of this alternative is $38.5 million for 30 years.	The present worth cost of this alternative is $67.1 million for 30 years.	The present worth cost of this alternative is $72.2 million for 30 years.	The present worth cost of this alternative is $82.4 million for 30 years.

Acronyms:

NRDCSRS – non-residential direct contact soil remediation standard
OFWD – open field/waste disposal area
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
CEA – classification exception area
OU – operable unit
ARARs – applicable or relevant and appropriate requirements
CAMU – Corrective Action Management Unit
LDR – land disposal restriction
T/M/V – toxicity/mobility/volume
EPA – Environmental Protection Agency
NJDEP – New Jersey Department of Environmental Protection

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Table 4-2
Cost Comparison of Alternatives
Matteo & Sons, Inc. Site
Thorofare, New Jersey

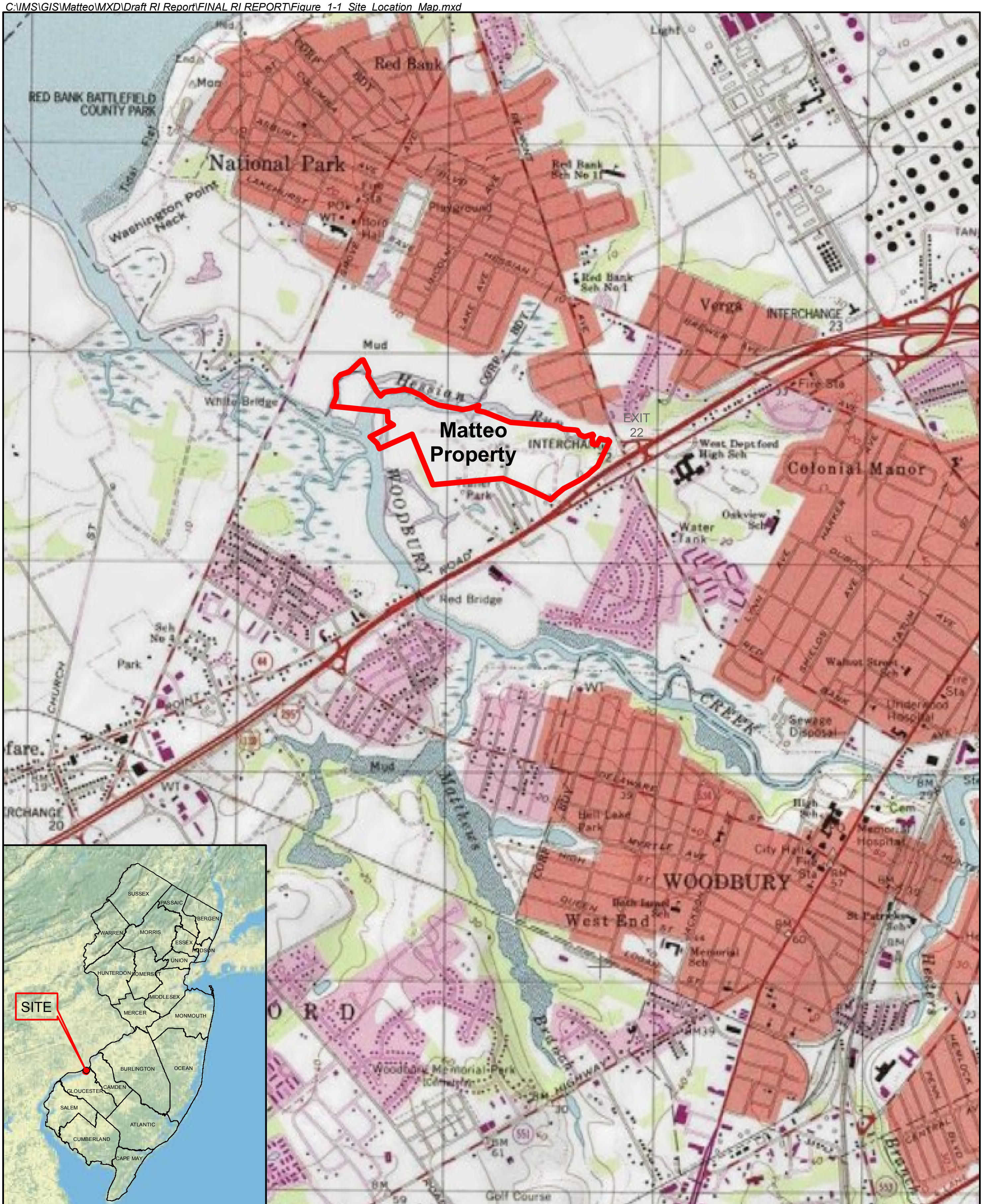
Cost Item	Alternative 1 No Action	Alternative 2 Excavation, Stabilization, On-site Containment, and Capping	Alternative 3 Excavation, Off-site Disposal of Source Materials, Stabilization, and Capping	Alternative 4 Excavation, Off-site Disposal of Source Materials and Contaminated Soils, and Capping	Alternative 5 Excavation and Off-site Disposal
Capital Costs	$0	$33,339,000	$65,835,000	$71,460,000	$82,032,000
Annual O&M Cost*	$0	$435,000	$124,000	$85,000	$50,000
Present Worth of O&M	$0	$5,124,000	$1,263,000	$785,000	$351,000
TOTAL PRESENT WORTH	$0	$38,463,000	$67,098,000	$72,245,000	$82,383,000

Notes:

* O&M cost includes inspection and maintenance and long-term monitoring if applicable for the alternative.

Figures

C:\IMS\GIS\Matteo\MXD\Draft RI Report\FINAL RI REPORT\Figure_1-1_Site_Location_Map.mxd



Source: USGS 7.5 Minute Quadrangle, Woodbury, NJ

N

0 500 1,000 2,000 3,000 Feet

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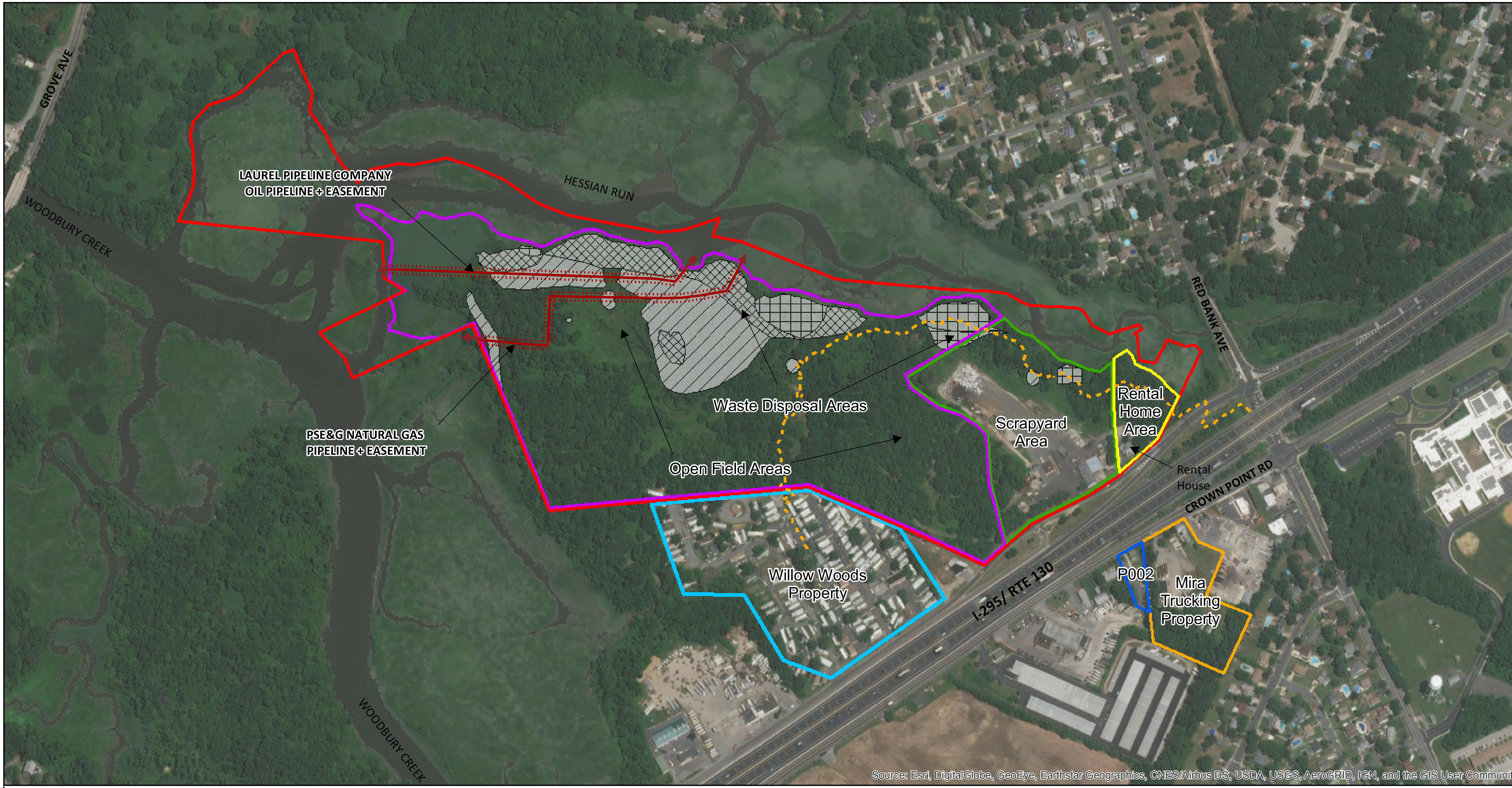
Figure 1-1
Site Location Map
Matteo & Sons, Inc. Site
Thorofare, NJ



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Municipal Waste
Approximate Extent of 100-Year Flood Event
Utility Line

N

0 200 400 800 Feet

1 inch = 400 feet

Figure 1-2
Site Plan
Matteo & Sons, Inc. Site
Thorofare, NJ

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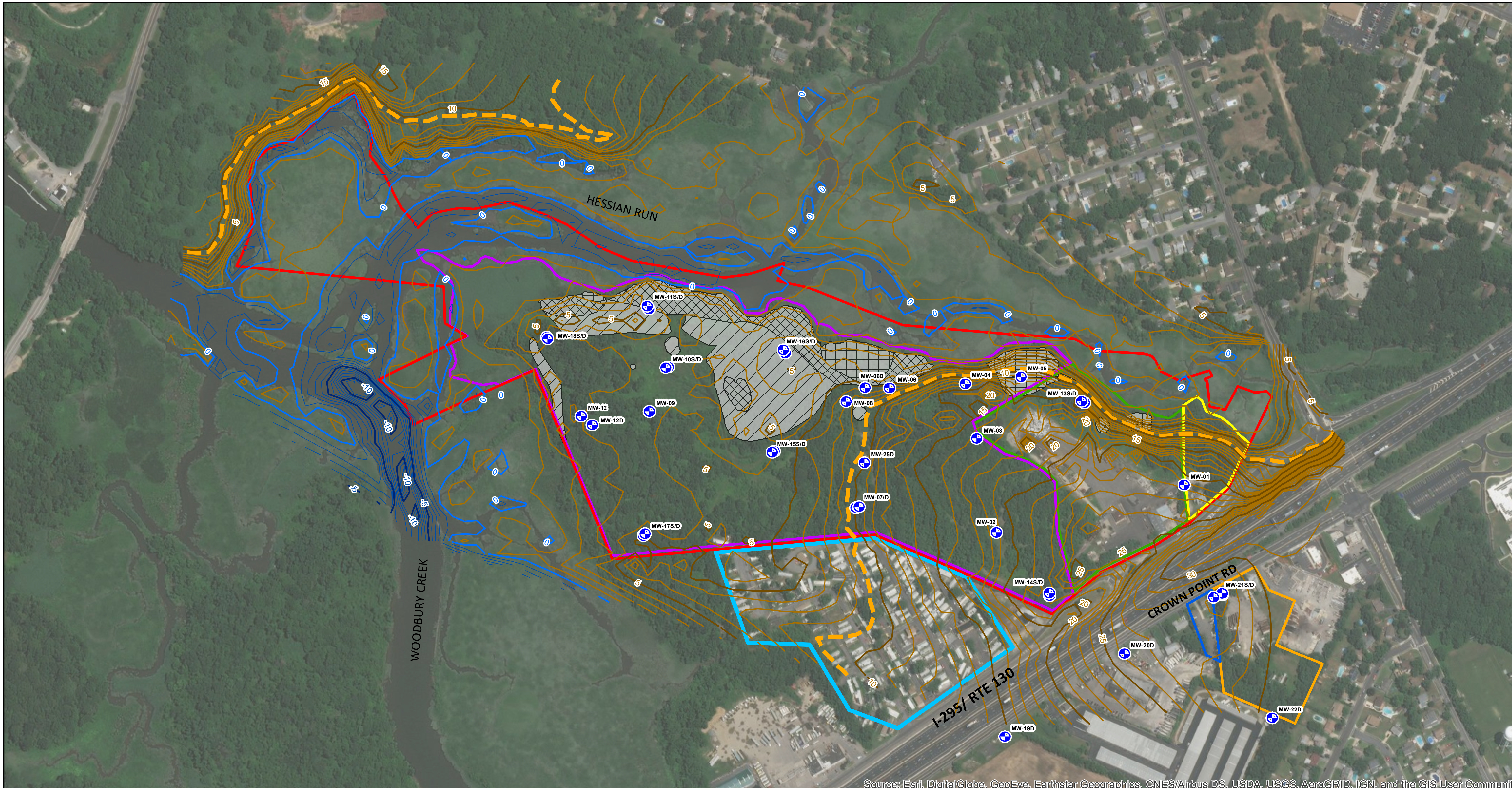
Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 1-2_Site_Plan.mxd



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Topography and Bathymetry

Topography (5 ft contours)
Topography (1 ft contours)
Mean Sea Level (msl)
Bathymetry (1 ft contours)
Bathymetry (5 ft contours)
Extent of 100- Year Flood Event (9 feet amsl)

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Municipal Waste

Monitoring Well

N

0 200 400 800 Feet

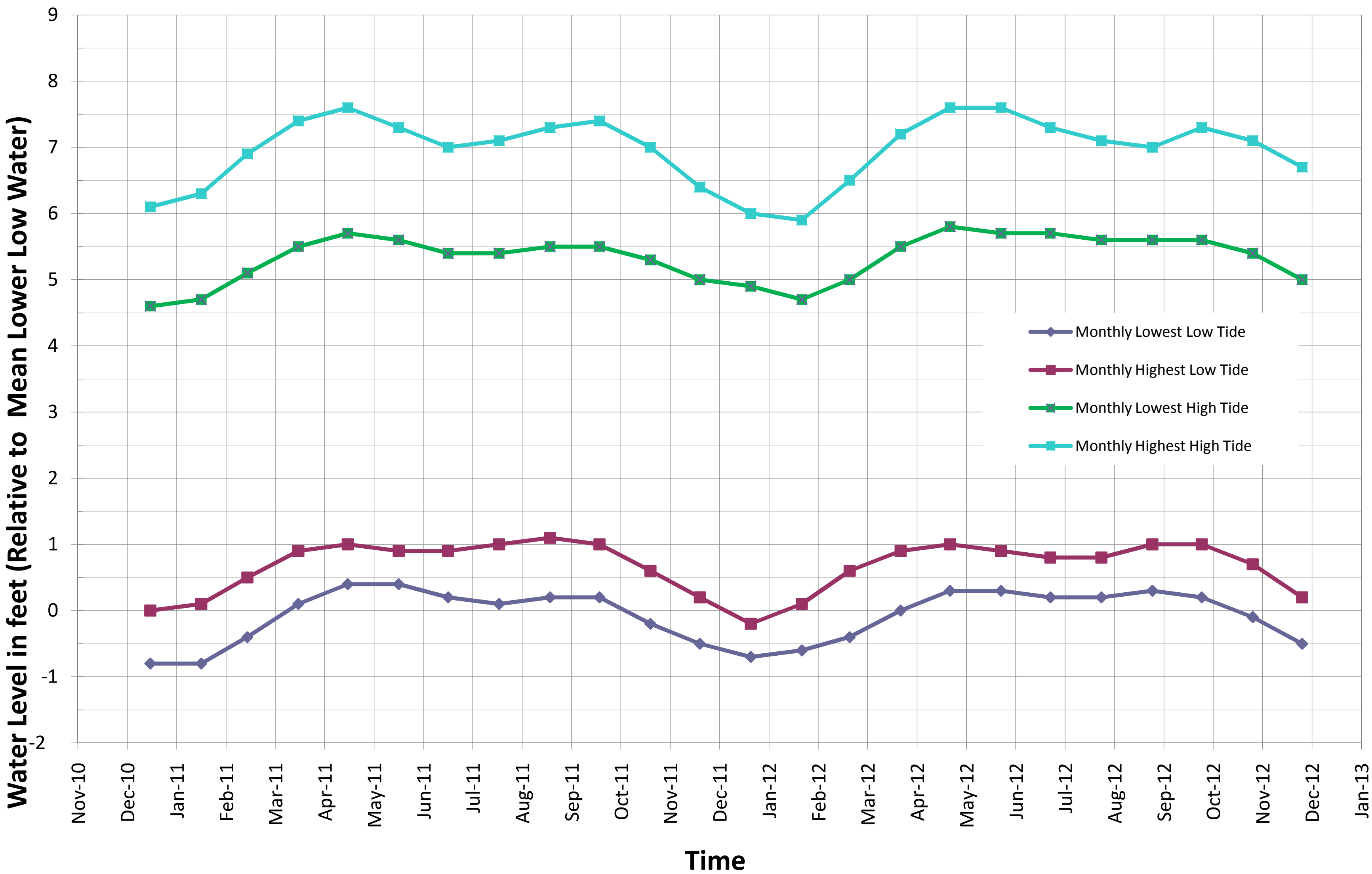
1 inch = 400 feet

Figure 1-3
Site Topography and Drainage
Matteo & Sons, Inc. Site
Thorofare, NJ

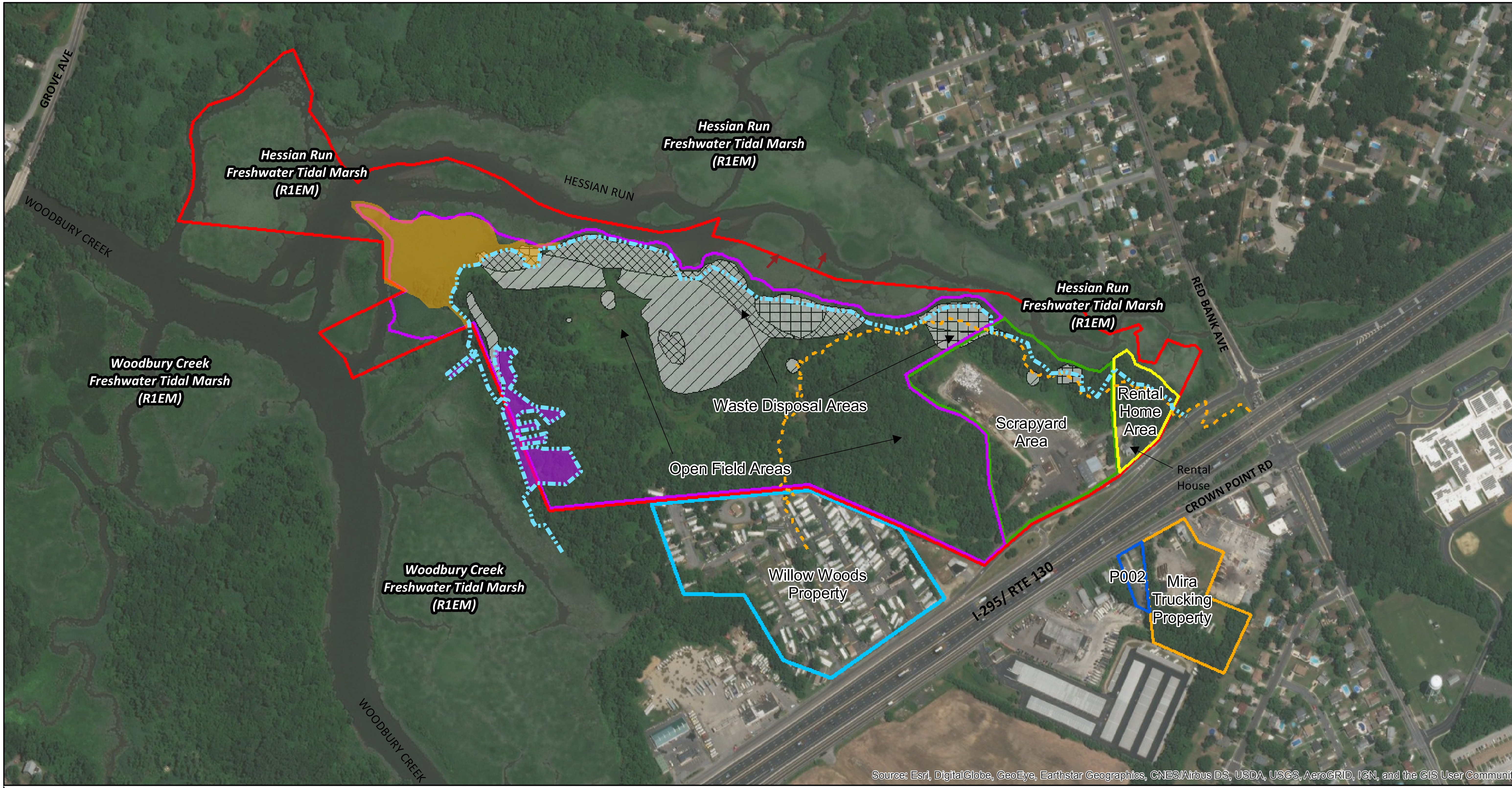
CDM Smith

schlosserm N:\Matteo\MXD\2018\FS\Final FS\Figure 1-3_Site_Topography_and_Drainage.mxd 4/17/2019

Figure 1-4
Monthly Tidal Fluctuation (Projected for Woodbury Creek)
Matteo & Sons, Inc. Site
Thorofare, New Jersey



CDM Smith



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Municipal Waste
Approximate Extent of 100-Year Flood Event

NJDEP Wetland Delineation (2000)

Wetland Delineation Line
PF01 - Palustrine Forested, Broad-leaved Deciduous Wetland
PEM1 - Palustrine Emergent Persistent Wetland

Source: The Louis Berger Group, Inc.
Vegetation Survey November 2000 and Wetland Delineation, December 2000 (for NJDEP)

N

0 200 400 800 Feet

1 inch = 400 feet

Figure 1-5
Wetland Delineation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure_1-5_Wetland Delineation.mxd

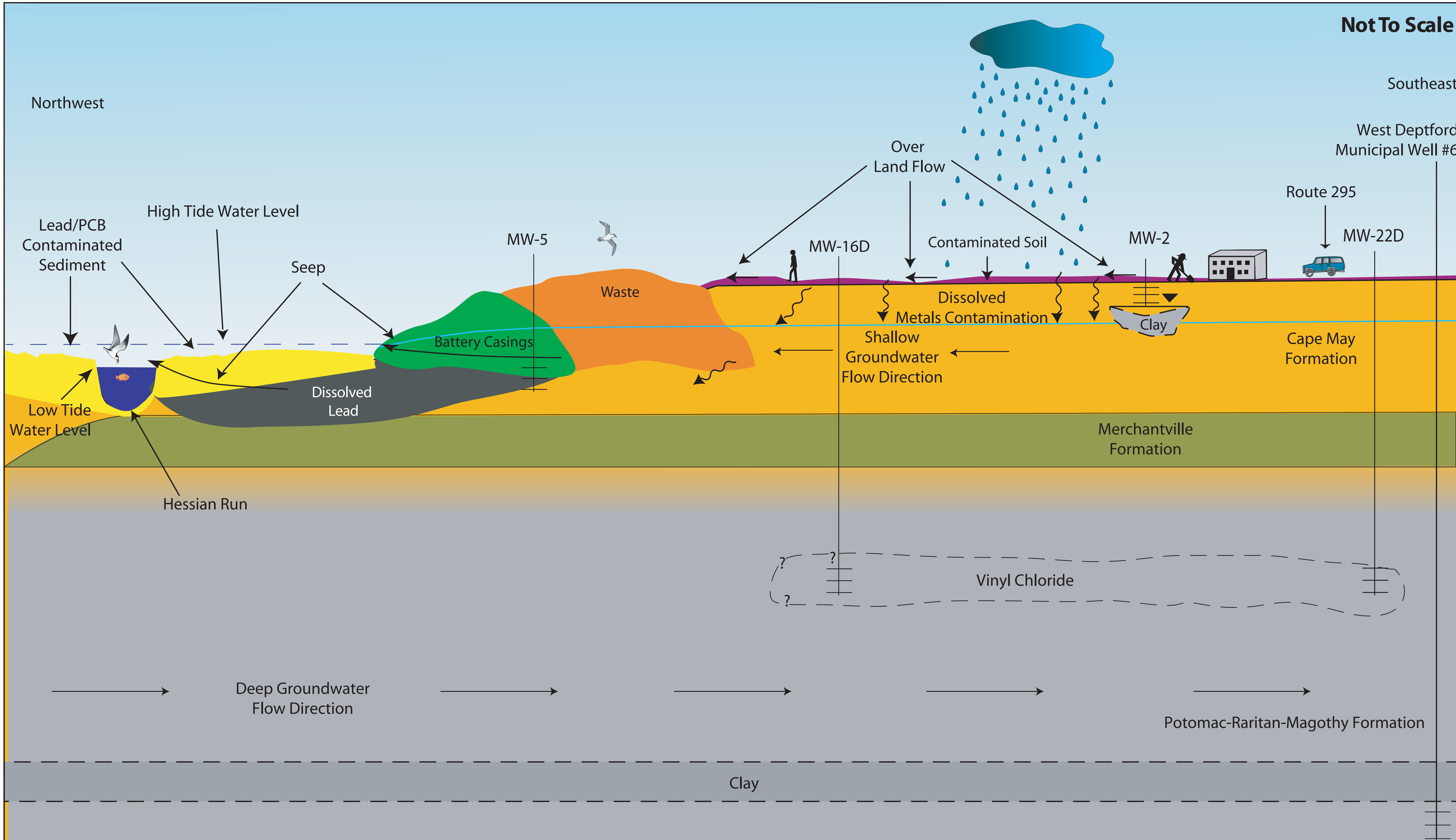
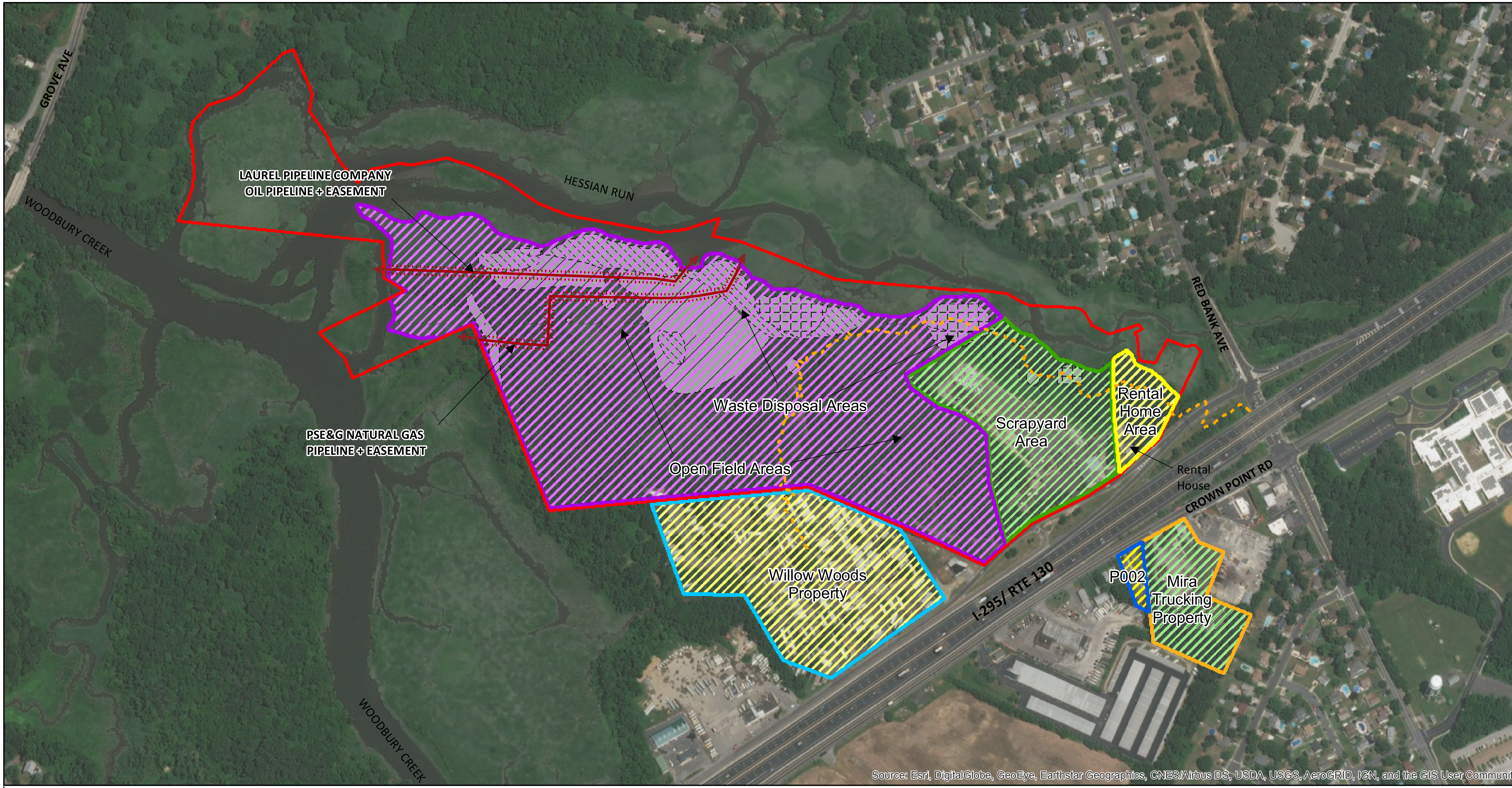


Figure 1-6
Conceptual Site Model Cross Section
Matteo & Sons, Inc. Site
Thorofare, NJ



- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Rental Home Area
- Willow Woods Property
- Mira Trucking Property
- Residential Property P002

Delineated Waste Disposal Areas

- Battery Casings and Waste
- Battery Casings
- Municipal Waste
- Approximate Extent of 100-Year Flood Event
- Utility Line

Preliminary Remediation Goals (PRGs) Applied to Various Site Areas

- Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)
- Residential PRGs (Rental Home, Willow Woods, and Residential Property P002) (Lead > 200 mg/kg or Total PCBs > 0.2 mg/kg)
- Commercial and Ecological PRGs (OFWD Area only) - (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg; except for upper foot for ecological PRG of Lead > 128 mg/kg)

N

0 200 400 800 Feet

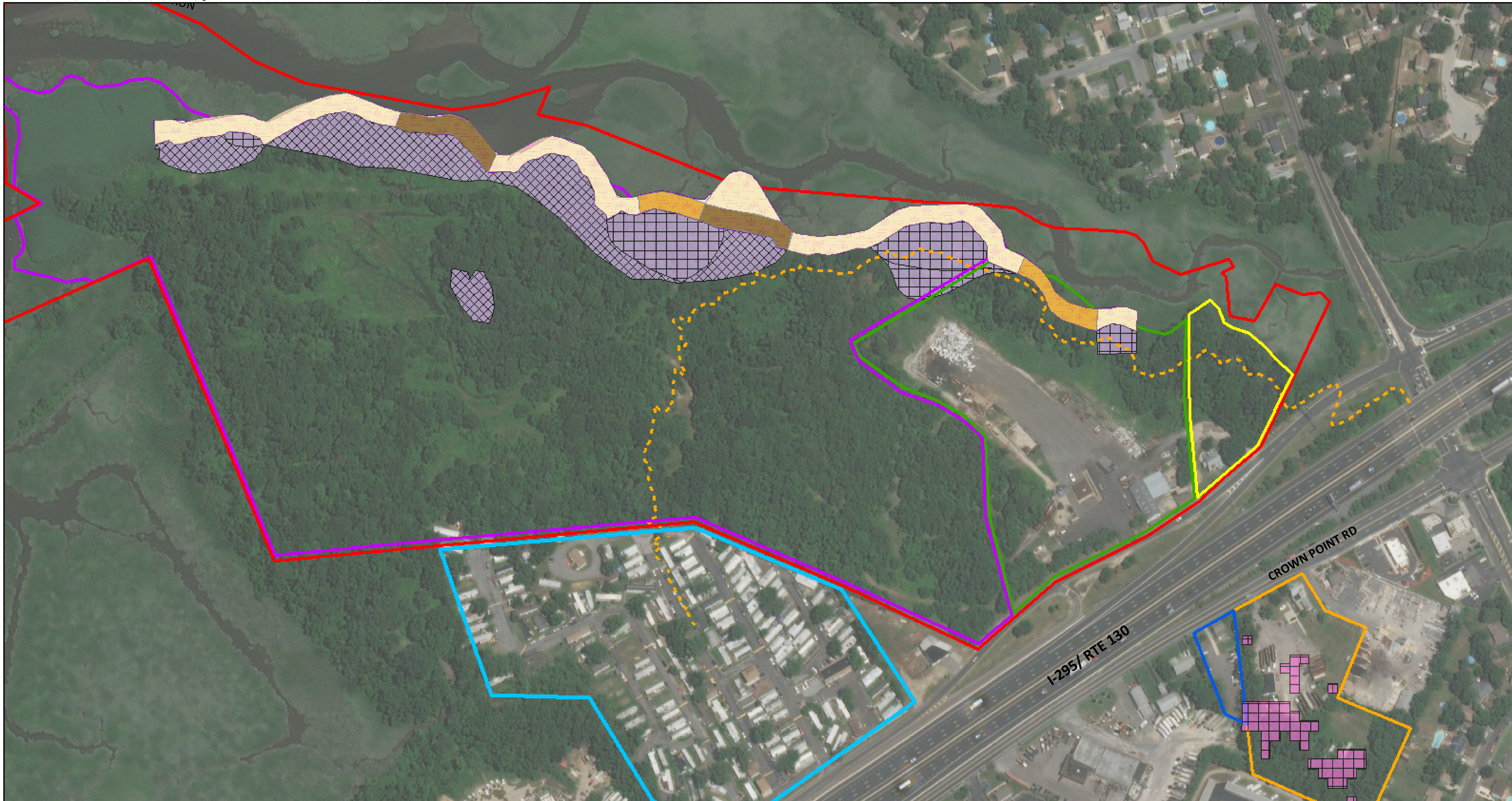
1 inch = 400 feet

Figure 2-1
Application of Preliminary Remediation Goals to Site Areas
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-1_PRGs.mxd

SCHLOSSERM N:\Matteo\MXD\2018\FS\Final FS\Figure 2-2 Extent of Source Materials.mxd 4/18/2019



- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Rental Home Area
- Willow Woods Property
- Mira Trucking Property
- Residential Property P002

Delineated Upland Source Material Areas

- Battery Casings Mixed w/ Municipal Waste
- Battery Casings
- Sediment with Intermixed Battery Casings

Battery Casings Mixed w/Sediment by Depth

- 0-1 ft
- 0-2 ft
- 0-3 ft

N

0 125 250 500 Feet

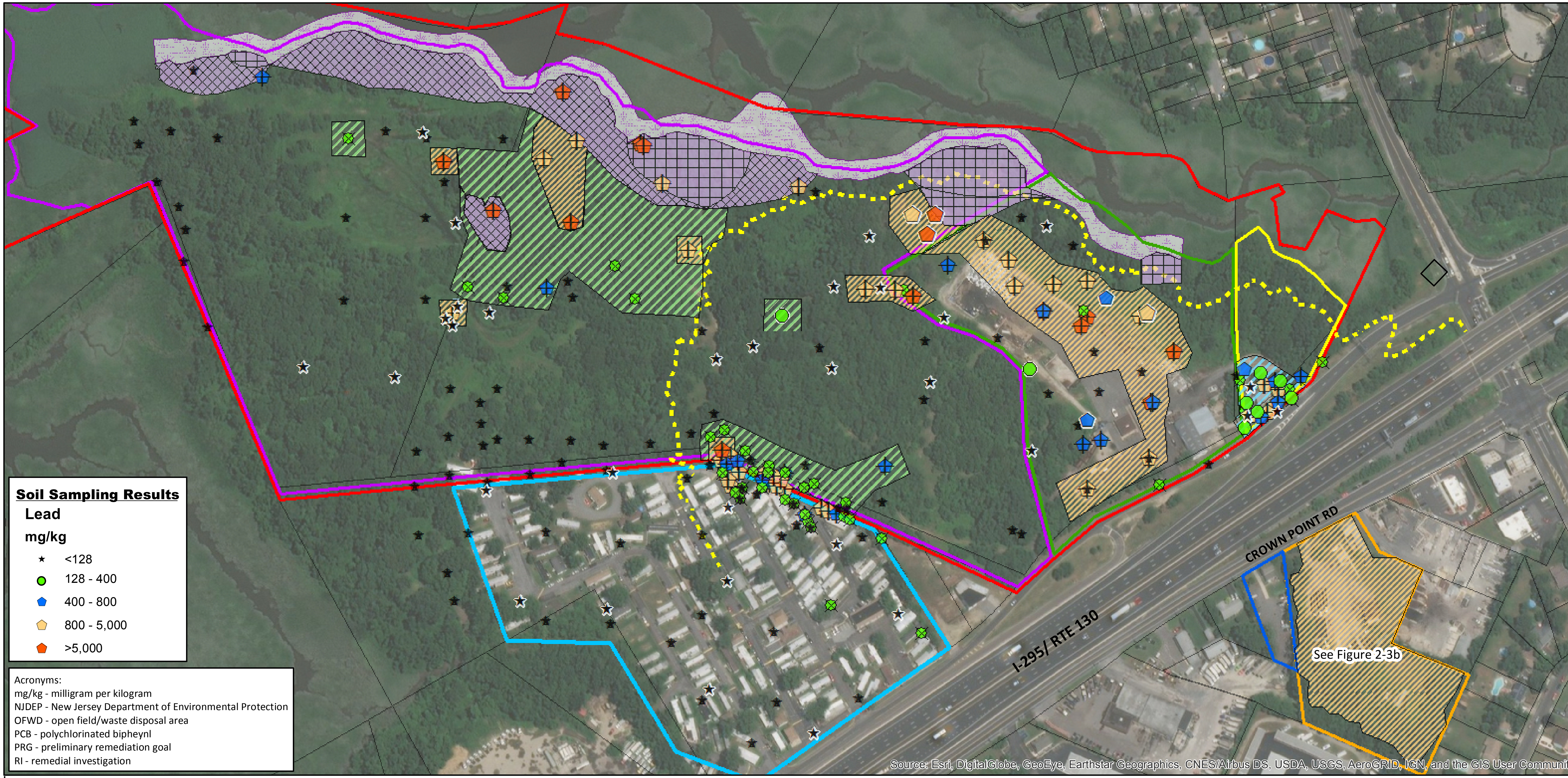
1 inch = 250 feet

Mira Trucking Delineated Source Material Areas

- > 10 Battery Casing Fragments on Surface

Figure 2-2
Extent of Source Materials
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Sediment with Intermixed Battery Casings

Soils Contaminated Above Preliminary Remediation Goals (PRGs)

Concentrations above Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)
Concentrations above Residential PRGs (Rental Home, Willow Woods, and Residential Property P002)
(Lead > 200 mg/kg or Total PCBs > 0.2 mg/kg)
Concentrations above Ecological PRGs (OFWD Area only) (Lead > 128 mg/kg - Background)

Notes

1. Soil sampling results are presented for both RI (2012/2015) and NJDEP RI Sampling.
NJDEP sampling results are shown with a cross through the symbol.
2. A removal action was performed on and adjacent to the Willow Woods property, the pre-removal results are shown, but not incorporated into the extent of contamination areas
3. Historic sample depths may not be representative of current conditions, particulary in the Scrapyard area where 2-3 feet of clean gravel have been added.
4. Source materials - Battery casing, mixed waste and battery casings mixed with sediments (purple shading) to be excavated.
5. Data for the Mira Trucking property and adjacent residential property P002 is shown on Figure 2-3b.

N

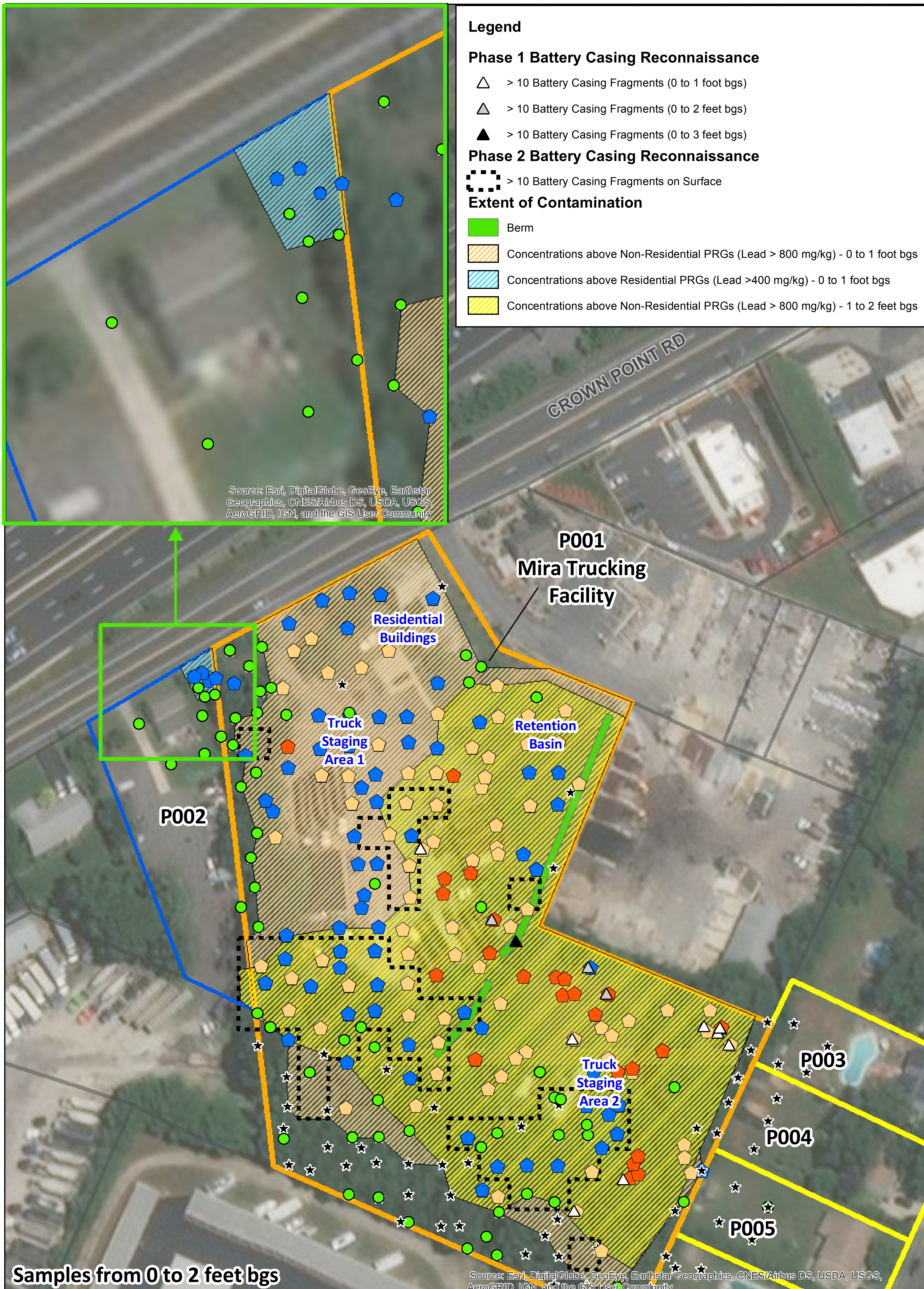
0 125 250 500 Feet

1 inch = 250 feet

Figure 2-3a
Extent of Lead Contamination in Surface Soils Requiring Remediation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-3a_Surface Lead.mxd



Matteo Property
Mira Trucking Property
Adjacent Residential Properties
Parcel Boundaries
Residential Property P002

Soil Sampling Results
Lead (mg/kg)
- <128
- 128 - 400
- 400 - 800
- 800 - 5,000
- >5,000

N

0 37.5 75 150 Feet

1 inch = 75 feet

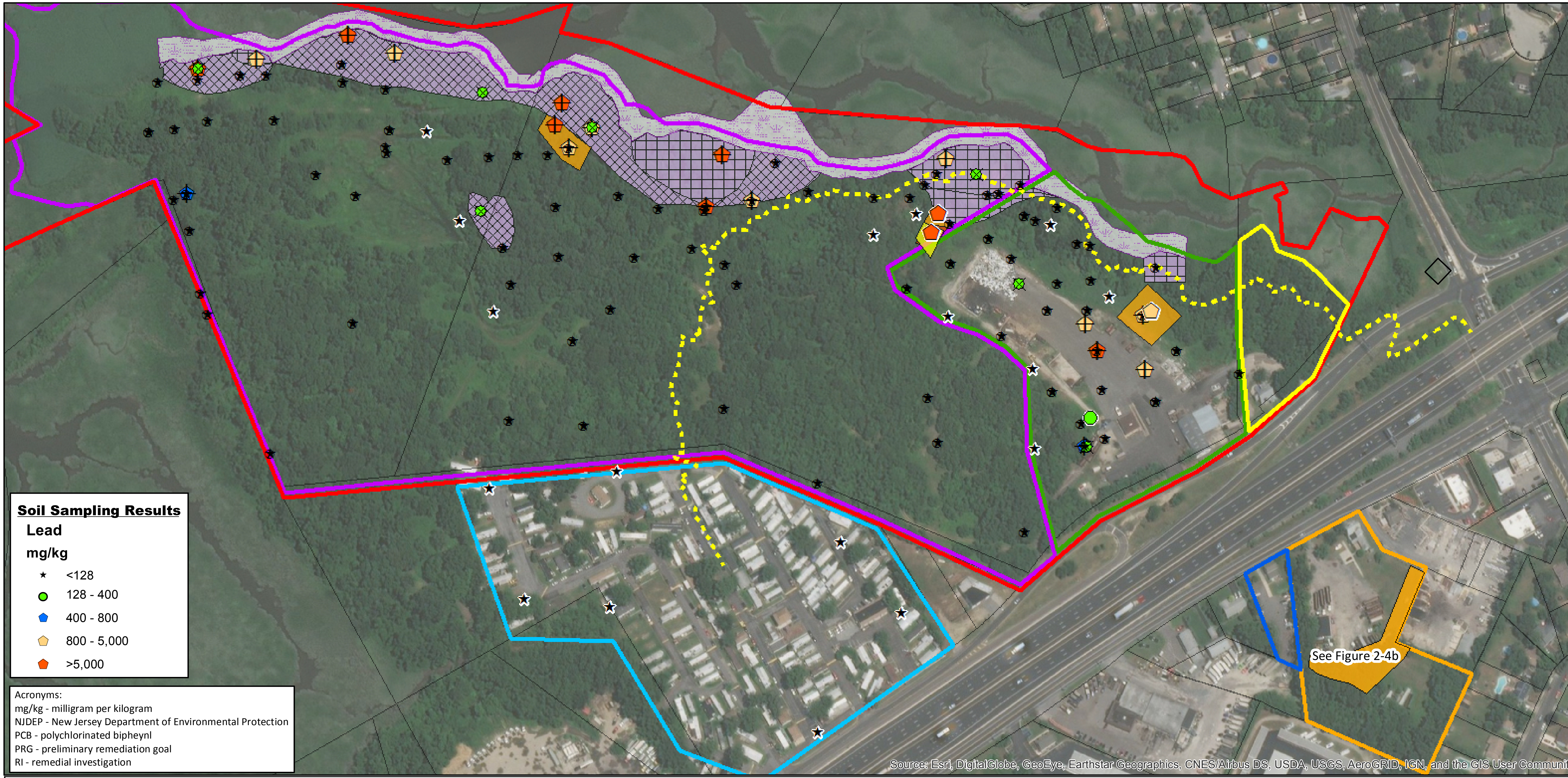
Figure 2-3b
Extent of Lead Contamination in Surface Soils Requiring Remediation - Mira Trucking
Matteo & Sons, Inc. Site
Thorofare, NJ

Acronyms:
bgs - below ground surface
EPA - environmental protection agency
mg/kg - milligram per kilogram
PRG - preliminary remediation goal
XRF - x-ray fluorescence

CDM Smith

Notes
1. Soil sampling results are presented for Phase 1 and Phase 2 EPA sampling.
2. XRF and laboratory sampling results are shown in mg/kg, and data is shown from 0 - 2 feet bgs.

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-3b Surface Lead_Mira.mxd



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Sediment with Intermixed Battery Casings

Soils Contaminated Above Preliminary Remediation Goals (PRGs)

Soils 2-4 feet bgs

Concentrations above Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)

Soils from 2-8 feet bgs

Concentrations above Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)

Notes

1. Soil sampling results are presented for both RI (2012/2015) and NJDEP RI Sampling. NJDEP sampling results are shown with a cross through the symbol.
2. A removal action was performed on the Willow Woods property, the pre-removal results have not been incorporated.
3. Historic sample depths may not be representative of current conditions, particulary in the Scrapyard area where 2-3 feet of clean gravel have been added.
4. Source materials - Battery casing, mixed waste and battery casings mixed with sediments (purple shading) to be excavated.
5. Data for the Mira Trucking property and adjacent residential property P002 is shown on Figure 2-4b.

N

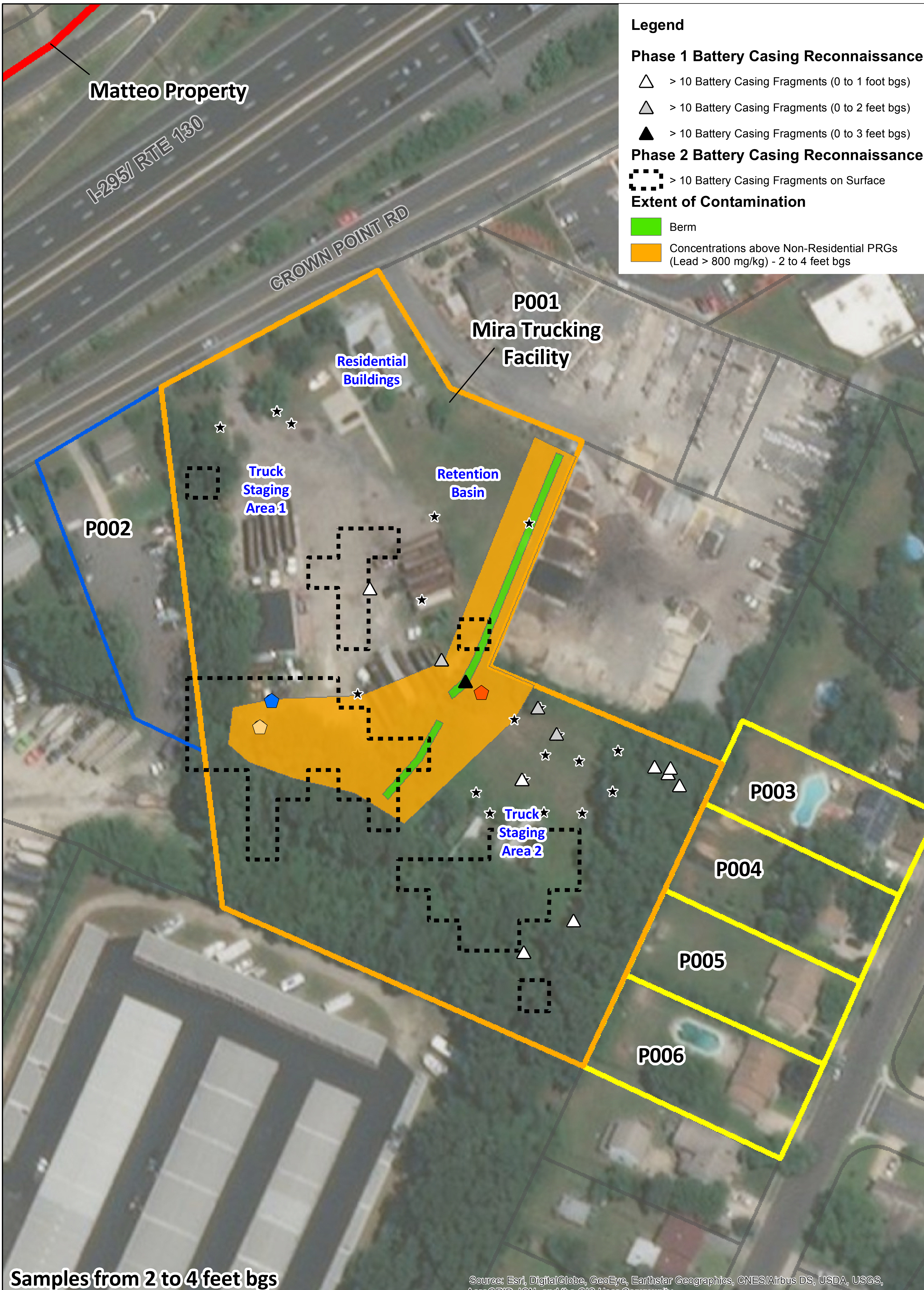
0 125 250 500 Feet

1 inch = 250 feet

Figure 2-4a
Extent of Lead Contamination in Subsurface Soils Requiring Remediation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-4a_Subsurface Lead.mxd



Matteo Property
Mira Trucking Property
Adjacent Residential Properties
Parcel Boundaries
Residential Property P002

Soil Sampling Results
Lead (mg/kg)
- <128
- 128 - 400
- 400 - 800
- 800 - 5,000
- >5,000

N

0 37.5 75 150 Feet
1 inch = 75 feet

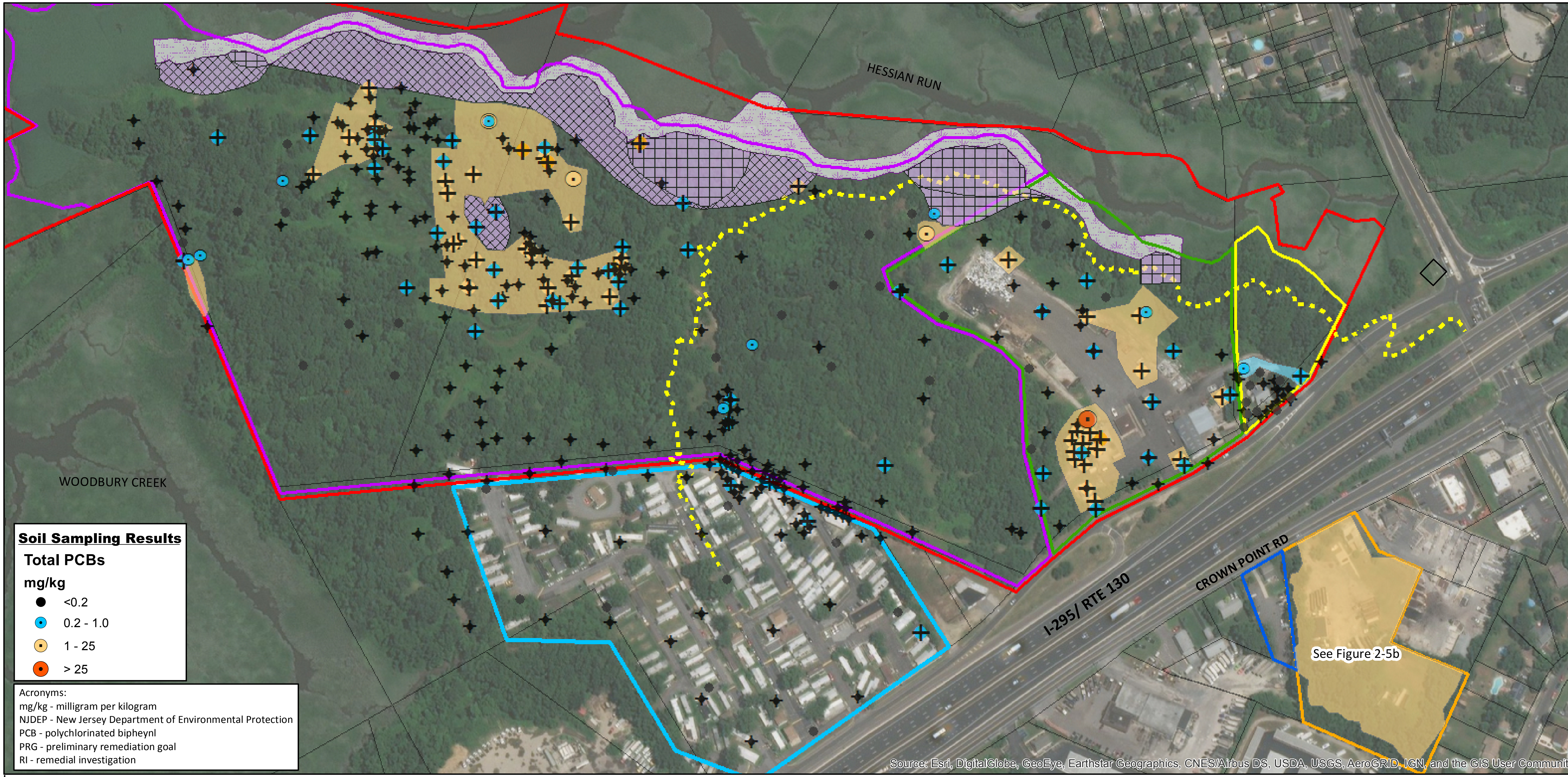
Figure 2-4b
Extent of Lead Contamination in Subsurface Soils Requiring Remediation - Mira Trucking
Matteo & Sons, Inc. Site
Thorofare, NJ

Notes
1. Soil sampling results are presented for Phase 1 and Phase 2 EPA sampling.
2. XRF and laboratory sampling results are shown in mg/kg.

Acronyms:
bgs - below ground surface
EPA - environmental protection agency
mg/kg - milligram per kilogram
PRG - preliminary remediation goal
XRF - x-ray fluorescence

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-4b_Subsurface Lead_Mira.mxd



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Sediment with Intermixed Battery Casings

Soils Contaminated Above Preliminary Remediation Goals (PRGs)

Concentrations above Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)

Concentrations above Residential PRGs (Rental Home, Willow Woods, and Residential Property P002) (Lead > 200 mg/kg or Total PCBs > 0.2 mg/kg)

Notes

1. Soil sampling results are presented for both RI (2012/2015) and NJDEP RI Sampling. NJDEP sampling results are shown with a cross through the symbol.
2. A removal action was performed on and adjacent to the Willow Woods property, the pre-removal results are shown, but not incorporated into the extent of contamination areas
3. Historic sample depths may not be representative of current conditions, particulary in the Scrapyard area where 2-3 feet of clean gravel have been added.
4. Source materials - Battery casing, mixed waste and battery casings mixed with sediments (purple shading) to be excavated.
5. Data for the Mira Trucking property and adjacent residential property P002 is shown in Figure 2-5b.

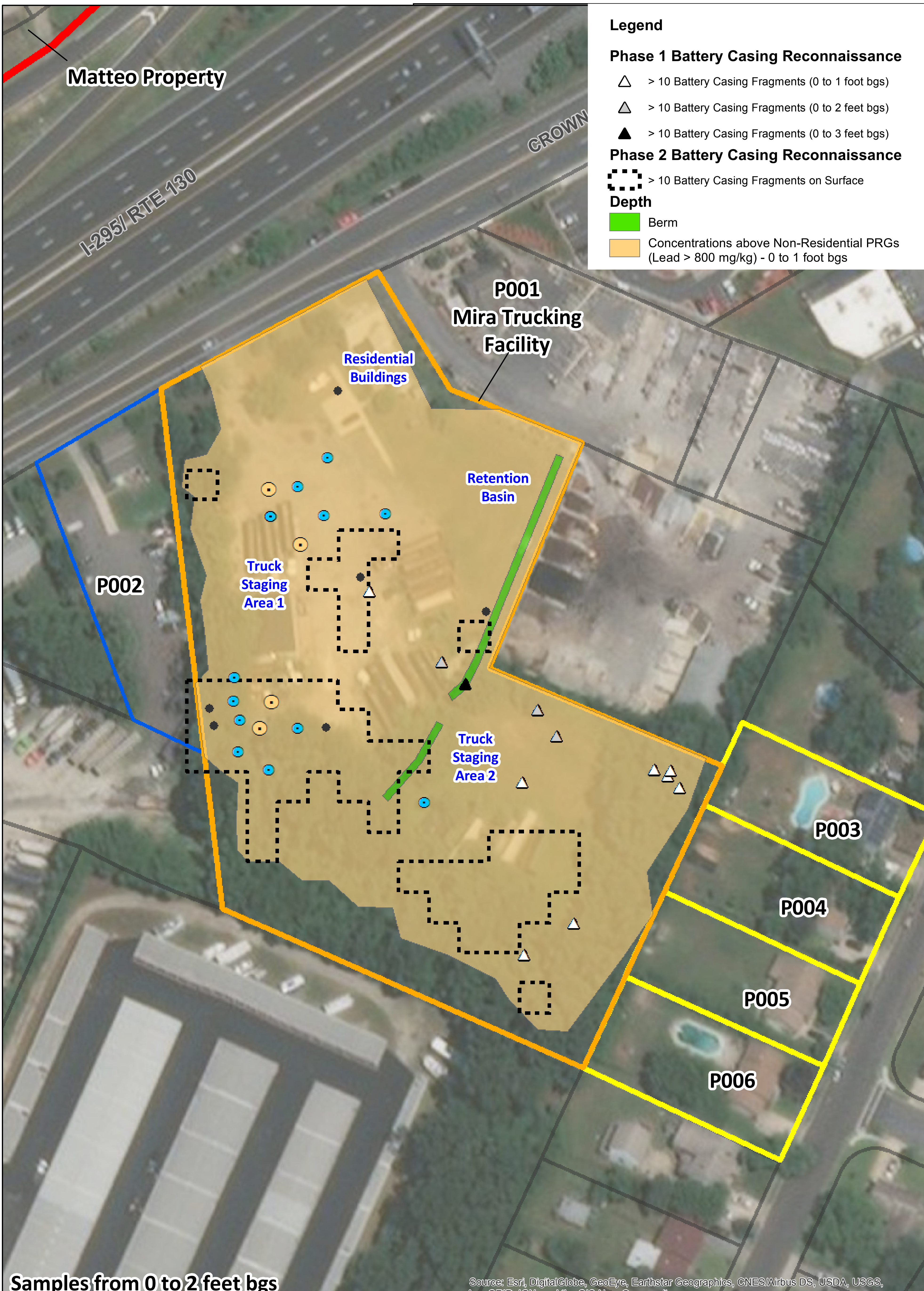
N

0 125 250 500 Feet

1 inch = 250 feet

Figure 2-5a
Extent of PCB Contamination in Surface Soils Requiring Remediation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith



Matteo Property
Mira Trucking Property
Adjacent Residential Properties
Parcel Boundaries
Residential Property P002

Soil Sampling Results
Total PCBs (mg/kg)
- <0.2
- 0.2 - 1.0
- 1 - 25
- > 25

N

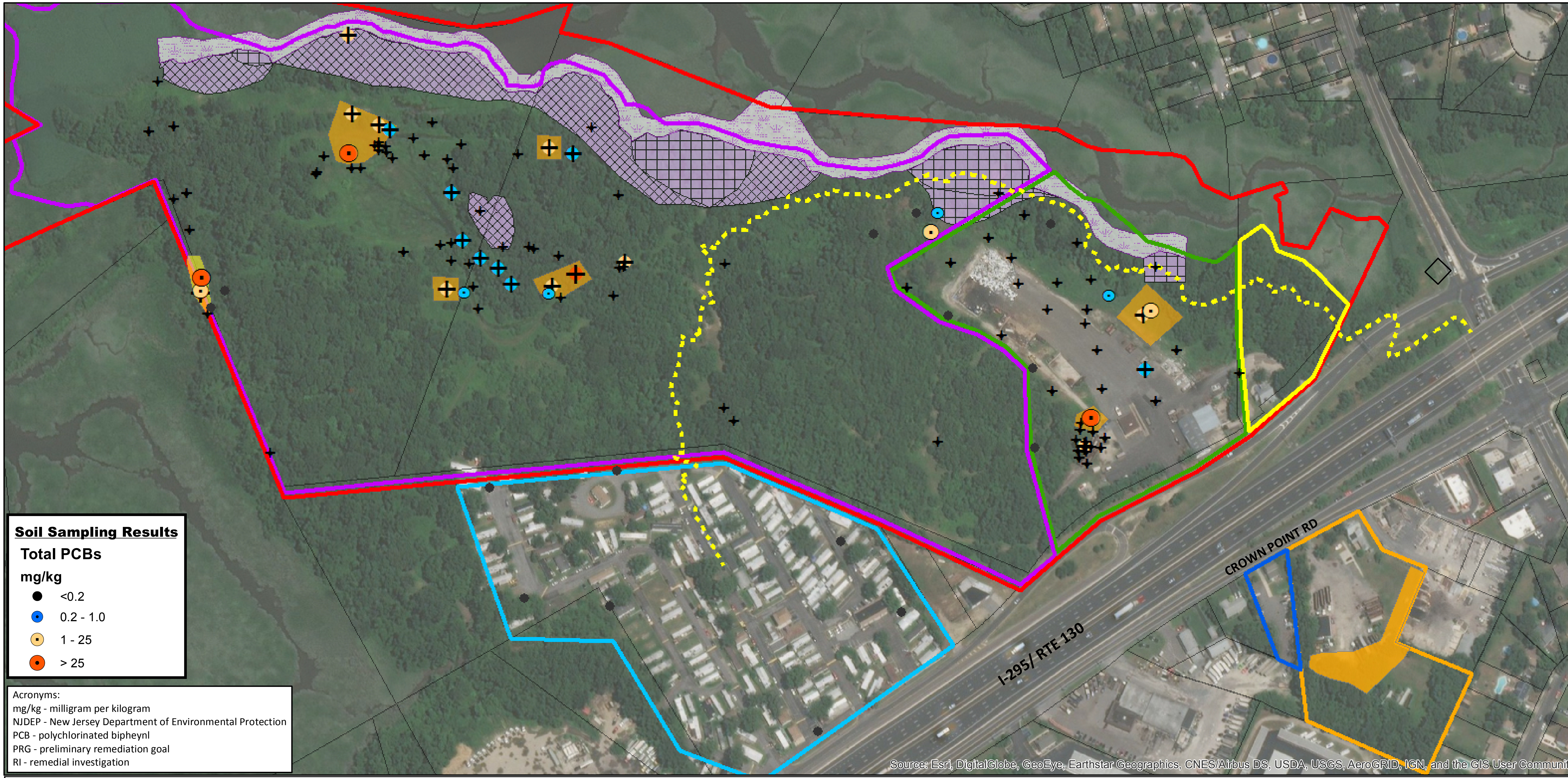
0 37.5 75 150 Feet
1 inch = 75 feet

Figure 2-5b
Extent of PCB Contamination in Surface Soils Requiring Remediation - Mira Trucking
Matteo & Sons, Inc. Site
Thorofare, NJ

Notes
1. Soil sampling results are presented for Phase 1 and Phase 2 EPA sampling.

Acronyms:
bgs - below ground surface
EPA - environmental protection agency
mg/kg - milligram per kilogram
PRG - preliminary remediation goal

CDM Smith



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Delineated Waste Disposal Areas

Battery Casings and Waste
Battery Casings
Sediment with Intermixed Battery Casings

Soils Contaminated Above Preliminary Remediation Goals (PRGs)

Soils 2-4 feet bgs

Concentrations above Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)

Soils from 2-8 feet bgs

Concentrations above Non-Residential PRGs (Lead > 800 mg/kg or Total PCBs > 1.0 mg/kg)

Notes

1. Soil sampling results are presented for both RI (2012/2015) and NJDEP RI Sampling. NJDEP sampling results are shown with a cross through the symbol.
2. A removal action was performed on the Willow Woods property, the pre-removal results have not been incorporated.
3. Historic sample depths may not be representative of current conditions, particulary in the Scrapyard area where 2-3 feet of clean gravel have been added.
4. Source materials - Battery casing, mixed waste and battery casings mixed with sediments (purple shading) to be excavated.
5. No samples were collected for PCB analysis from 2 to 8 feet bgs on the Mira Trucking Property.

N

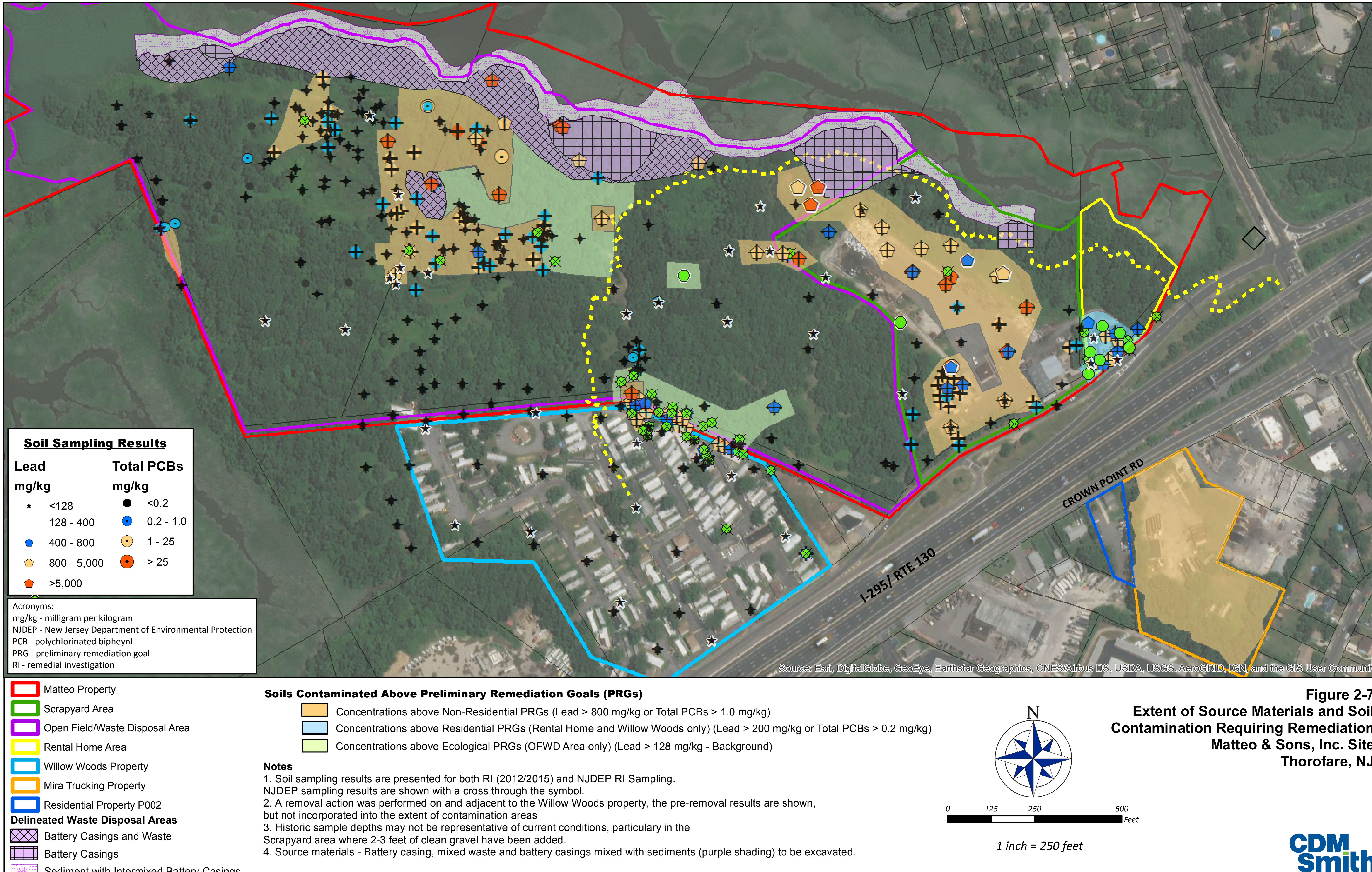
0 125 250 500 Feet

1 inch = 250 feet

Figure 2-6
Extent of PCB Contamination in Subsurface Soils Requiring Remediation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-6_Subsurface PCBs.mxd



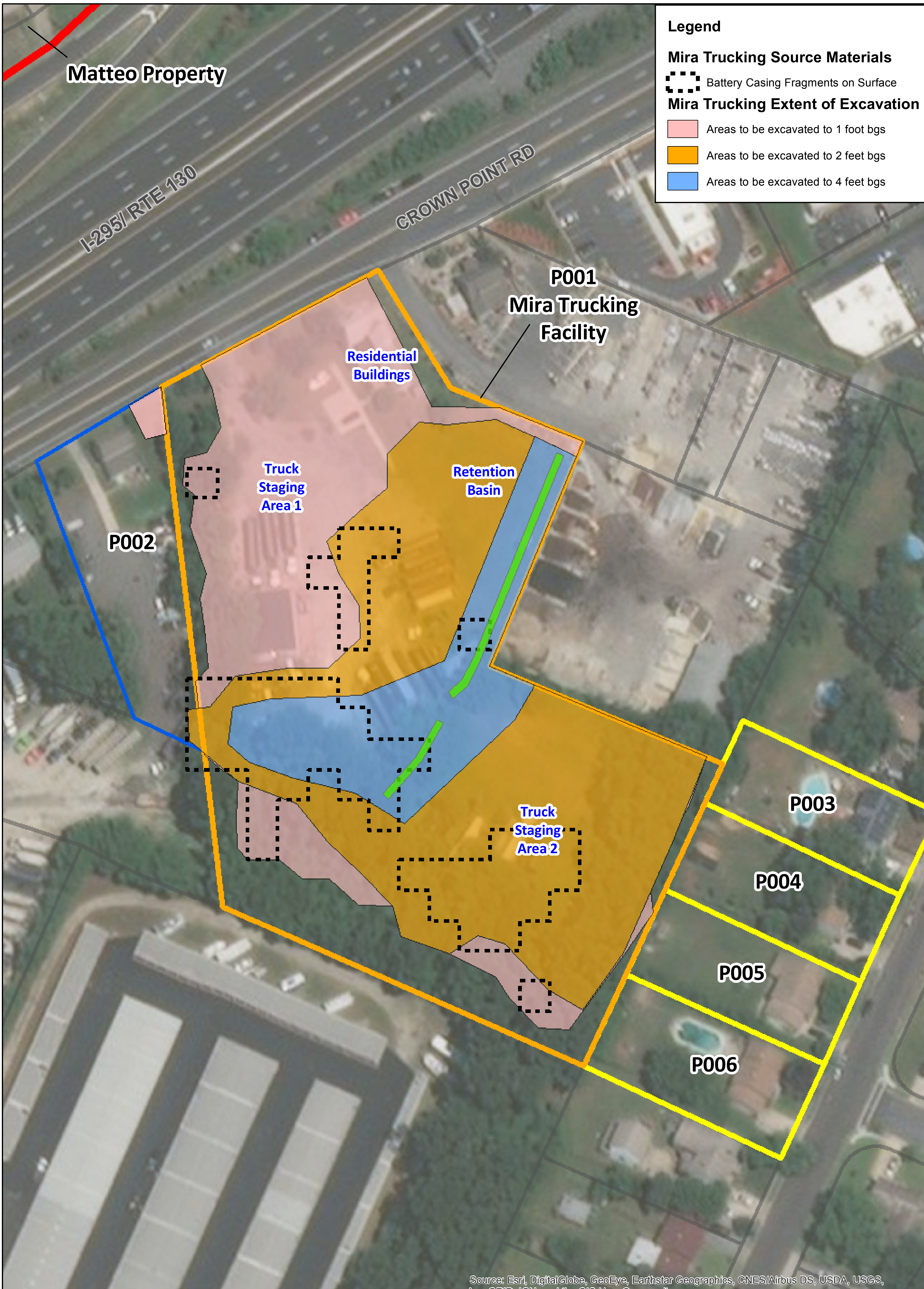
Notes

1. Soil sampling results are presented for both RI (2012/2015) and NJDEP RI Sampling. NJDEP sampling results are shown with a cross through the symbol.
2. A removal action was performed on and adjacent to the Willow Woods property, the pre-removal results are shown, but not incorporated into the extent of contamination areas
3. Historic sample depths may not be representative of current conditions, particulary in the Scrapyard area where 2-3 feet of clean gravel have been added.
4. Source materials - Battery casing, mixed waste and battery casings mixed with sediments (purple shading) to be excavated.

Figure 2-7
Extent of Source Materials and Soil Contamination Requiring Remediation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 2-7_Combined_Rem_areas.mxd



- Matteo Property
- Mira Trucking Property
- Adjacent Residential Properties
- Parcel Boundaries
- Residential Property P002

Acronyms:
bgs - below ground surface

N

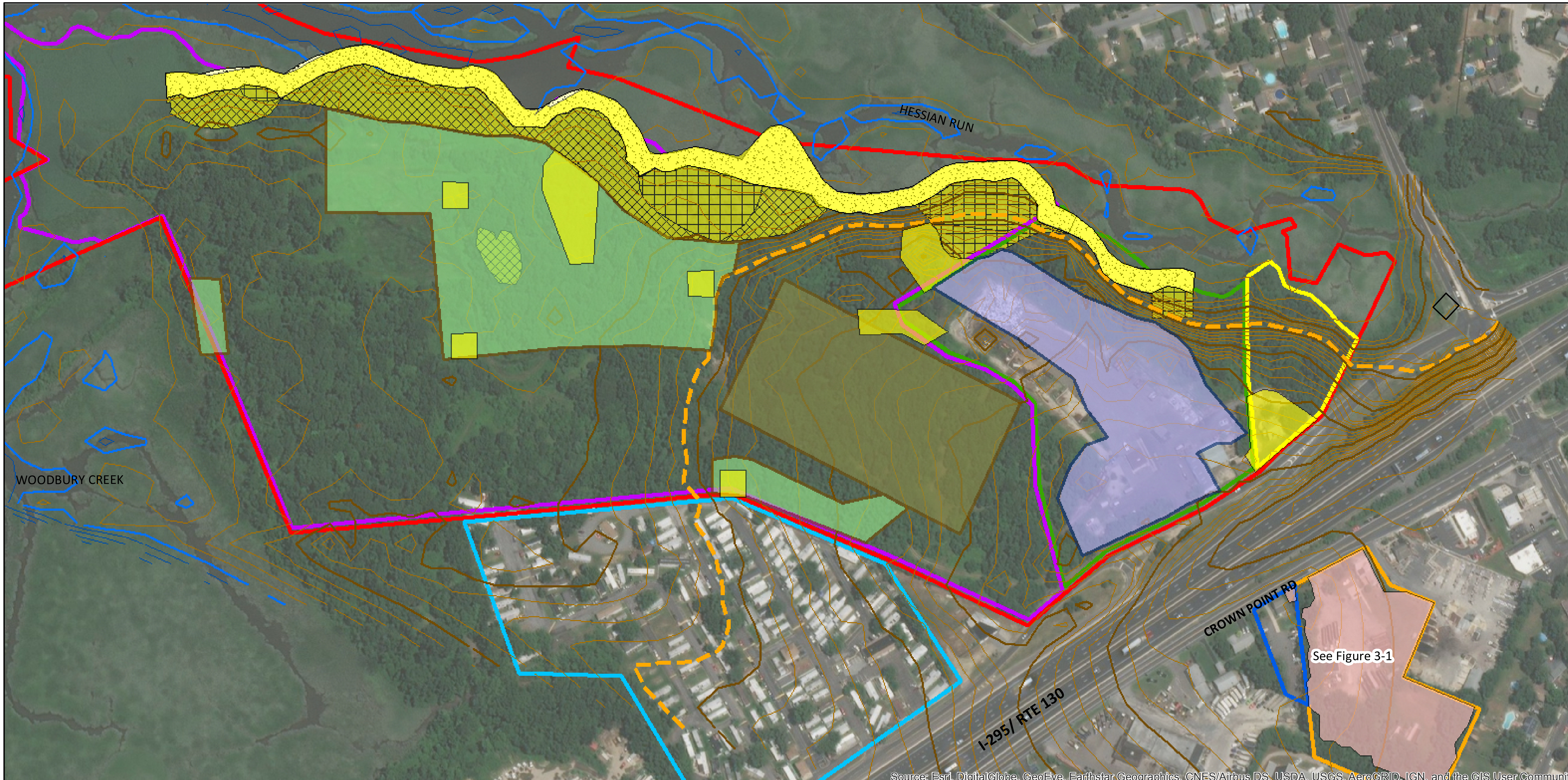
0 37.5 75 150 Feet

1 inch = 75 feet

Figure 3-1
Conceptual Layout for Mira Trucking Excavation
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Document Path: N:\Matteo\MXD\2018\FS\Final FS\Figure 3-1 Conceptual Layout for Mira Trucking.mxd



- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Rental Home Area
- Willow Woods Property
- Mira Trucking Property
- Residential Property P002

Source Materials

- Battery Casings
- Battery casings mixed with waste
- Battery casings mixed with sediment

- Topography (5 ft contours)
- Topography (1 ft contours)
- Mean Sea Level (msl)
- Bathymetry (1 ft contours)
- Bathymetry (5 ft contours)
- Extent of 100- Year Flood Event (9 feet amsl)

Acronyms

ECO - ecological
PCB - polychlorinated biphenyl
PRG - preliminary remediation goal
OFWD - Open field/ waste disposal area
RH - Rental home area
SY - Scrapyard area

Remedial Alternative Areas

- Areas to be excavated. Lead-contaminated soils in the OFWD, RH, and WW soils with lead > PRGs (excluding ECO PRGs) will be stabilized ex situ. Source materials will be placed in a containment cell.)
- Area above 100 year flood zone where an engineered containment cell for battery casings will be located.
- Areas where stabilized materials would be spread to cover PCB contamination, areas with lead> ECO PRGs, and waste piles and capped with clean fill soil cover.
- Area of asphalt cap (includes SY area soils with lead and PCB contamination)
- Areas to be excavated and disposed of offsite (Mira Trucking)

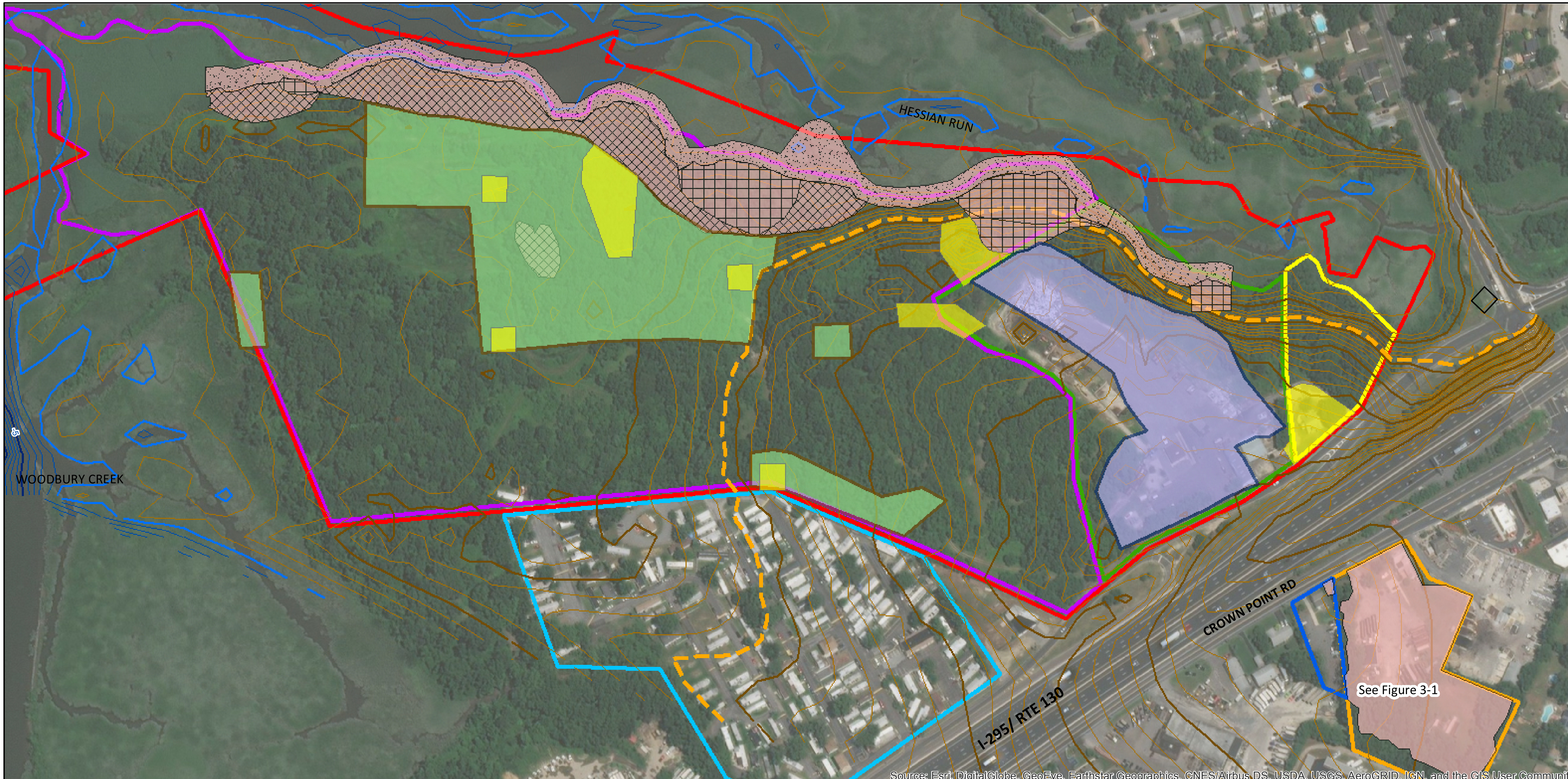
N

0 125 250 500 Feet

1 inch = 250 feet

Figure 3-2
Conceptual Layout for Alternative 2
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Source Materials

Battery Casings
Battery casings mixed with waste
Battery casings mixed with sediment

Topography (5 ft contours)
Topography (1 ft contours)
Mean Sea Level (msl)
Bathymetry (1 ft contours)
Bathymetry (5 ft contours)
Extent of 100- Year Flood Event (9 feet amsl)

Acronyms

ECO - ecological
PCB - polychlorinated biphenyl
PRG - preliminary remediation goal
OFWD - Open field/ waste disposal area
RH - Rental home area
SY - Scrapyard area

Remedial Alternative Areas

Areas to be excavated and stabilized ex-situ (includes OFWD and RH area soils with lead > PRGs (excluding ECO PRGs)

Areas to be excavated and disposed of offsite (source materials + Mira Trucking)

Areas where stabilized materials would be spread to cover PCB contamination, areas with lead> ECO PRGs, and waste piles and capped with clean fill soil cover.

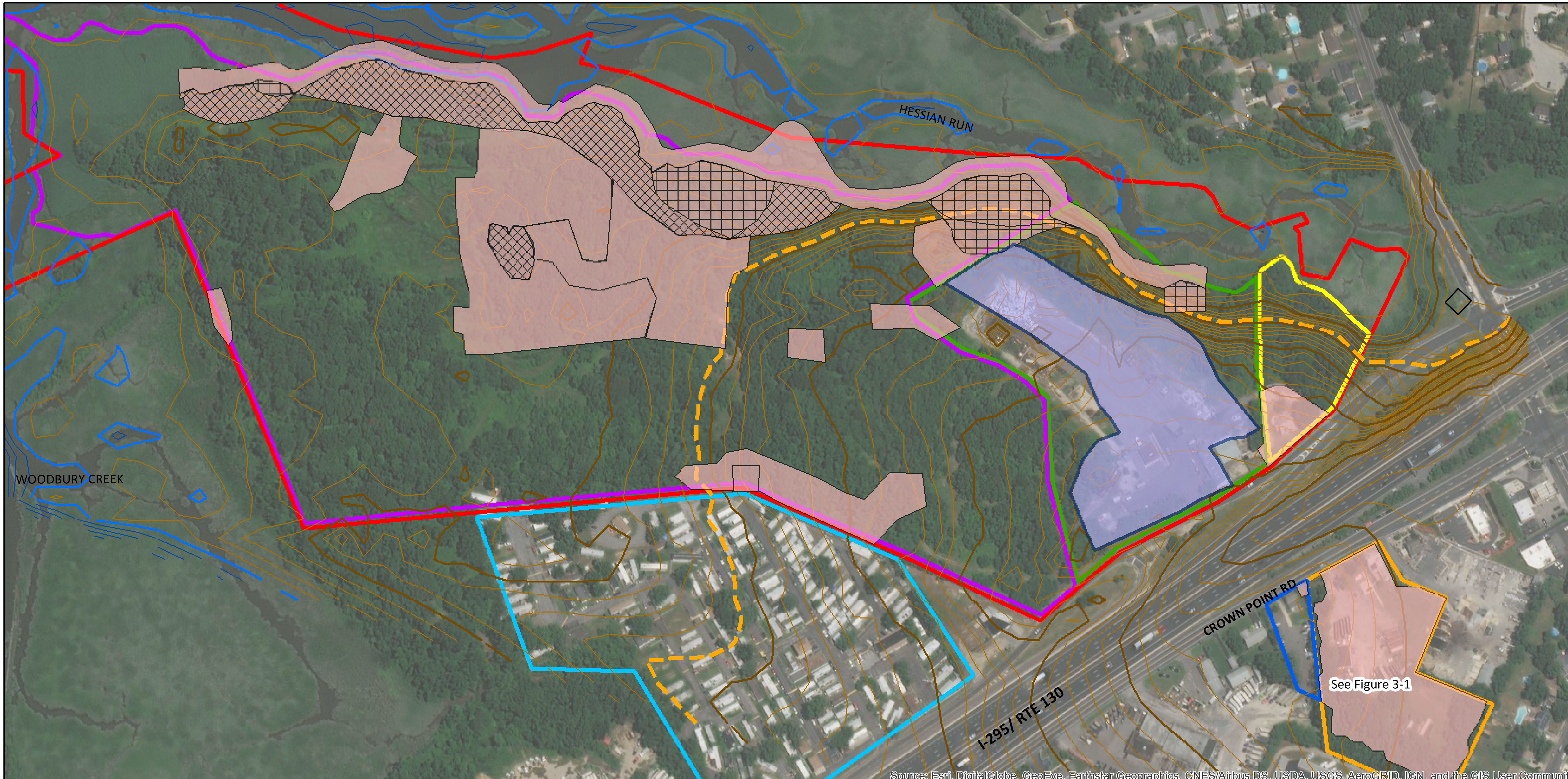
Area of Asphalt Cap (includes SY area soils with lead and PCB contamination)

N

0 125 250 500 Feet

1 inch = 250 feet

Figure 3-3
Conceptual Layout for Alternative 3
Matteo & Sons, Inc. Site
Thorofare, NJ



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Source Materials

Battery Casings
Battery casings mixed with waste
Battery casings mixed with sediment

Topography (5 ft contours)
Topography (1 ft contours)
Mean Sea Level (msl)
Bathymetry (1 ft contours)
Bathymetry (5 ft contours)
Extent of 100- Year Flood Event (9 feet amsl)

Acronyms

ECO - ecological
PCB - polychlorinated biphenyl
PRG - preliminary remediation goal
OFWD - Open field/ waste disposal area
RH - Rental home area
SY - Scrapyard area

Remedial Alternative Areas

Areas to be excavated and disposed of offsite (include source materials, and OFWD, Mira Trucking, and RH area soils with lead or PCBs > PRGs)

Area of Asphalt Cap (includes SY area soils with lead and PCB contamination)

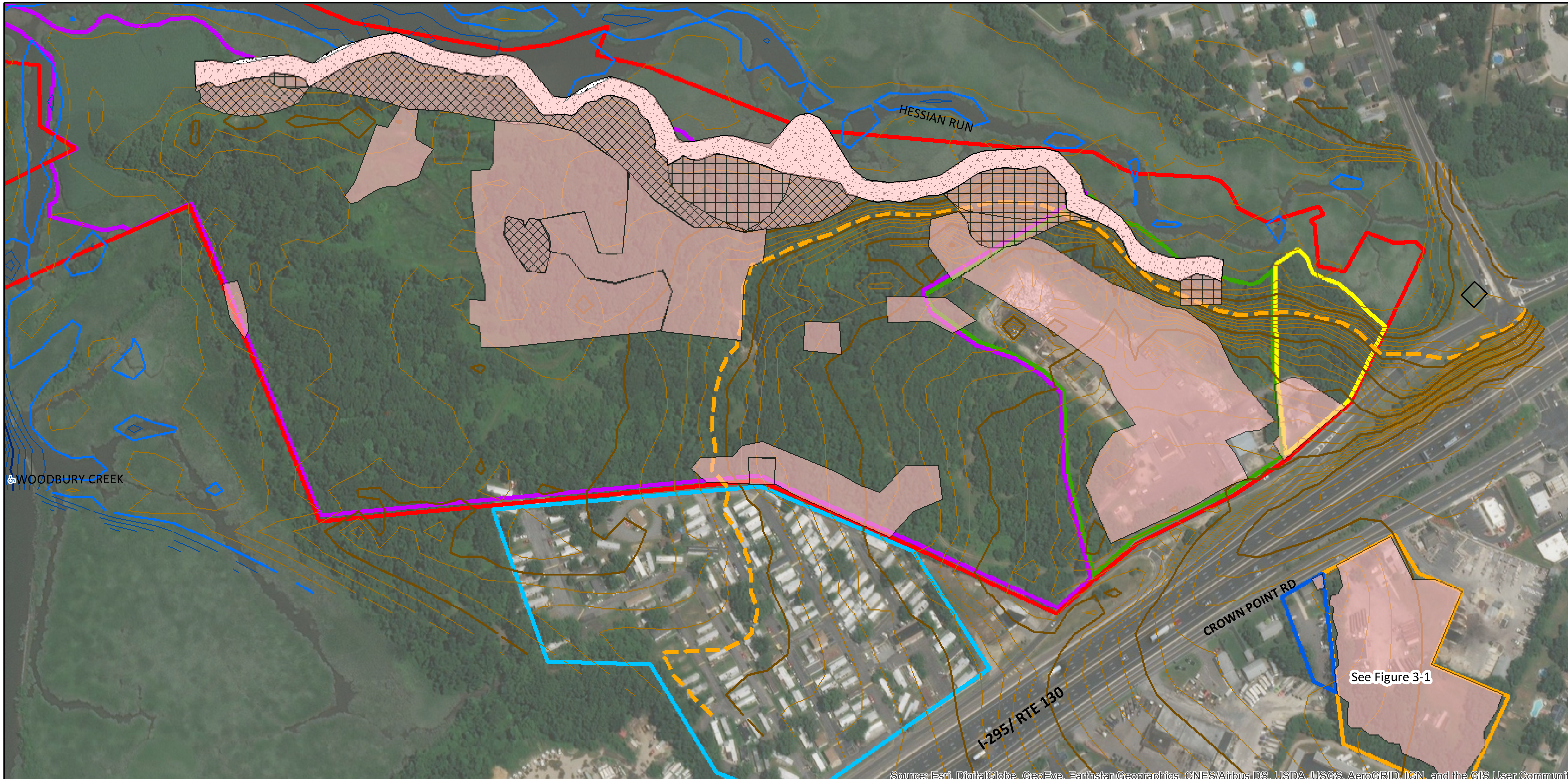
N

0 125 250 500 Feet

1 inch = 250 feet

Figure 3-4
Conceptual Layout for Alternative 4
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property
Mira Trucking Property
Residential Property P002

Source Materials

Battery Casings
Battery casings mixed with waste
Battery casings mixed with sediment

Topography (5 ft contours)
Topography (1 ft contours)
Mean Sea Level (msl)
Bathymetry (1 ft contours)
Bathymetry (5 ft contours)
Extent of 100- Year Flood Event (9 feet amsl)

Acronyms

ECO - ecological
PCB - polychlorinated biphenyl
PRG - preliminary remediation goal
OFWD - Open field/ waste disposal area
RH - Rental home area
SY - Scrapyard area

Remedial Alternative Areas

Areas to be excavated and disposed of offsite (includes source materials; and OFWD, SY, RH and Mira Trucking soils with lead or PCBs > PRGs)

N

0 125 250 500 Feet

1 inch = 250 feet

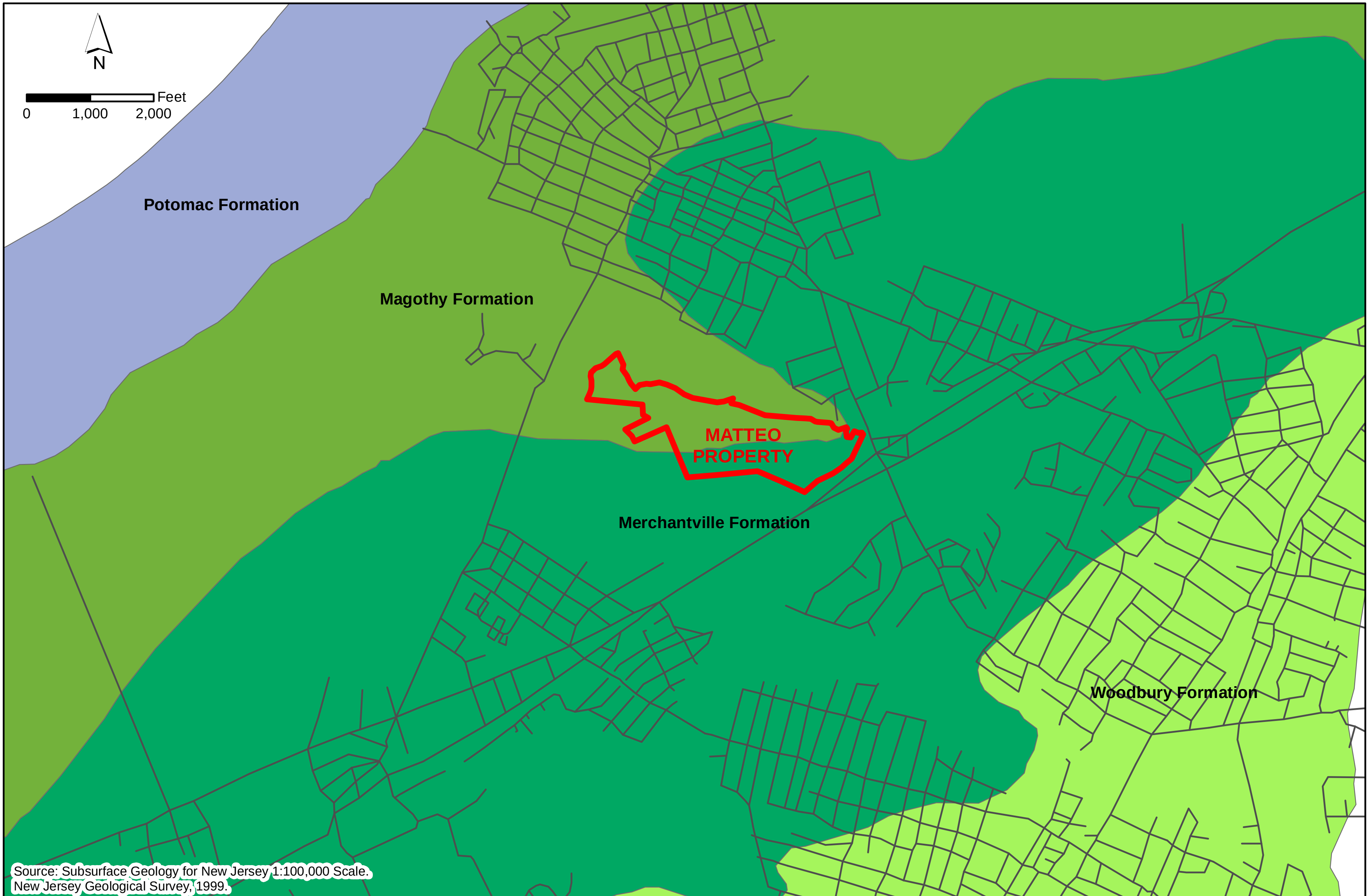
Figure 3-5
Conceptual Layout for Alternative 5
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

Appendix A

Appendix A

Select RI Figures



MAGOTHY FORMATION - Quartz sand, fine to very course grained with thin beds of clay and silt. Sand is white, yellow, light gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown reddish yellow where weathered, gray to black where unweathered. As much as 120 feet thick. Sand inlcudes some lignite, pyrite and minor feldspar and mica. Silt and clay bed include mica and carbonaceous material. Late Cretaceous (Santonian) in age based on pollen (Christopher, 1977). Pollen in the Magothy in the Woodbury quadrangle in the Westville area confrims the age and corellation (Jengo, 1999). Unconformably overlies the Potomoac Formation

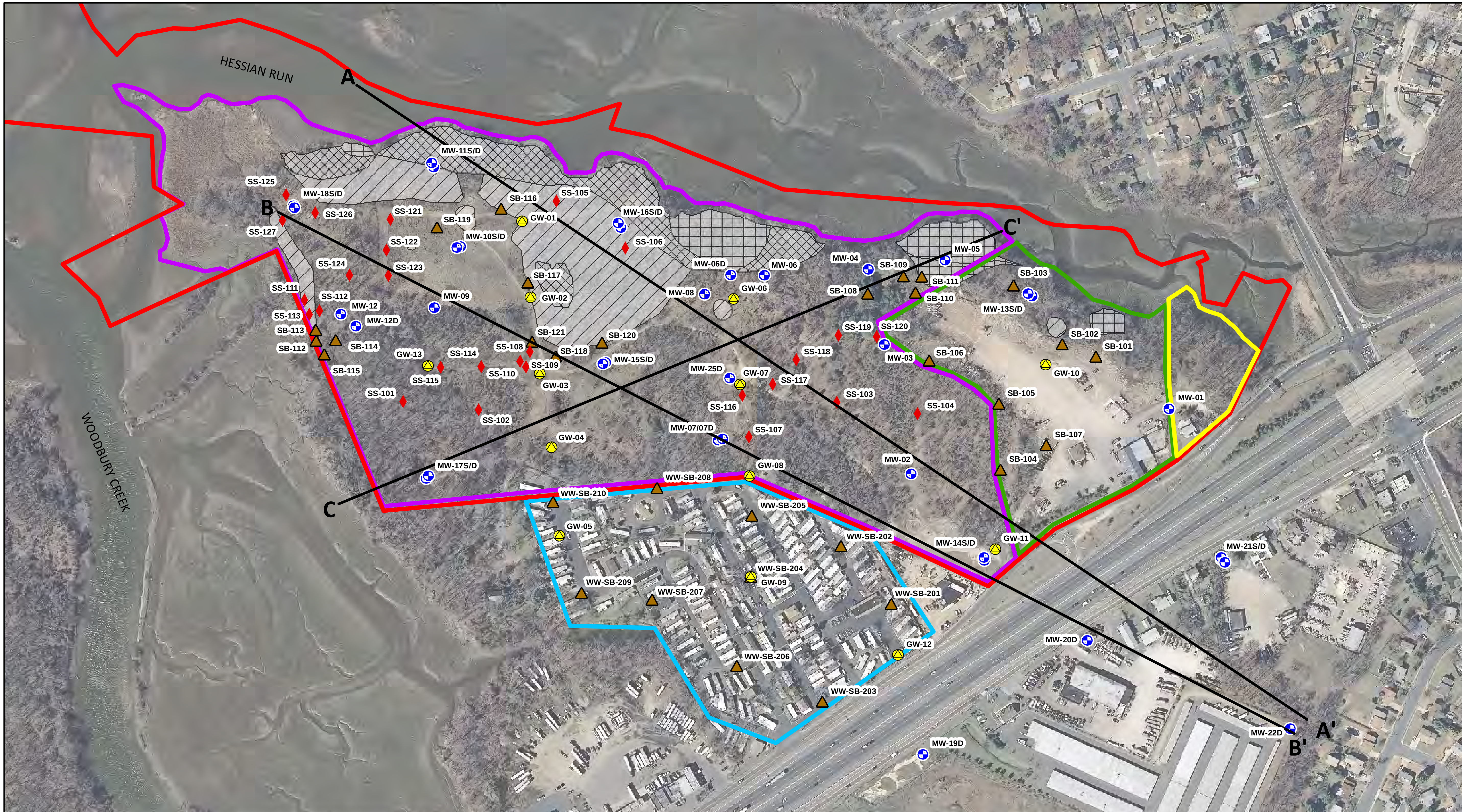
MERCHANTVILLE FORMATION - Glauconite sandy clay. Olive, dark gray, black where weathered, olive brown to yellowish brown where weathered. As much as 40 feet thick. Glauconite occurs primarily in soft grains of fine to medium sand size. Sand fraction is chiefly quartz; feldspar, mica, and pyrite are minor constituents. Iron cemwentation is common. Late Createaceous (early Campanian) in age based on ammonite fossils (Owens and others, 1977). The Merchantville-Magothy contact between Westville and Verga in the northeastern corner of the quadrangle is from well data in Jengo (1999). Unconformably overlies the Magothy Formation.

WOODBURY FORMATION - Clay with minor thin beds of very fine quartz sand. Dark gray and black where unweathered, yellowish brown to brown where weathered. As much as 40 feet thick. Clay is micaceous with some pyrite and carbonaceous material and traces of glauconite. Late Cretaceous (early Campanian) in age based on pollen (Wolfe, 1976). Grades downward into the Merchantville Formation.

POTOMAC FORMATION - Quartz sand, fine to very coarse grained, and clay and silt, thin- to thick-bedded; minor granule to cobble gravel. Sand is white, yellow, light gray where weathered, gray where unweathered. Clay and silt are white, yellow brown, reddish yellow where weathered, less commonly gray to black where unweathered. As much as 220 feet thick. Sand includes some lignite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. The Potomac Formation in the Woodbury quadrangle is equivalent to the Potomac Formation, unit 3 (Doyle and Robbins, 1977), based on pollen (Owens and others, 1998) and is late Createceous (early Crenomanian) in age. Outcrop belt in the Woodbury quadrangle is entirely covered by surficial deposists but unit is penetrated by boreholes (Jengo, 1999). Unconformably overlies Cambrian and Late Proterozoic bedrock.

CDM Smith

Figure 3-5
Subsurface Geology
Matteo & Sons, Inc. Site
Thorofare, NJ



Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property

RI Groundwater Screening Location
Monitoring Well
RI Soil Boring
RI Surface Soil

Delineated Waste Disposal Areas

Batteries and Waste
Batteries
Waste

N

0 150 300 600 Feet

1 inch = 300 feet

Figure 3-6
Cross section Location Map
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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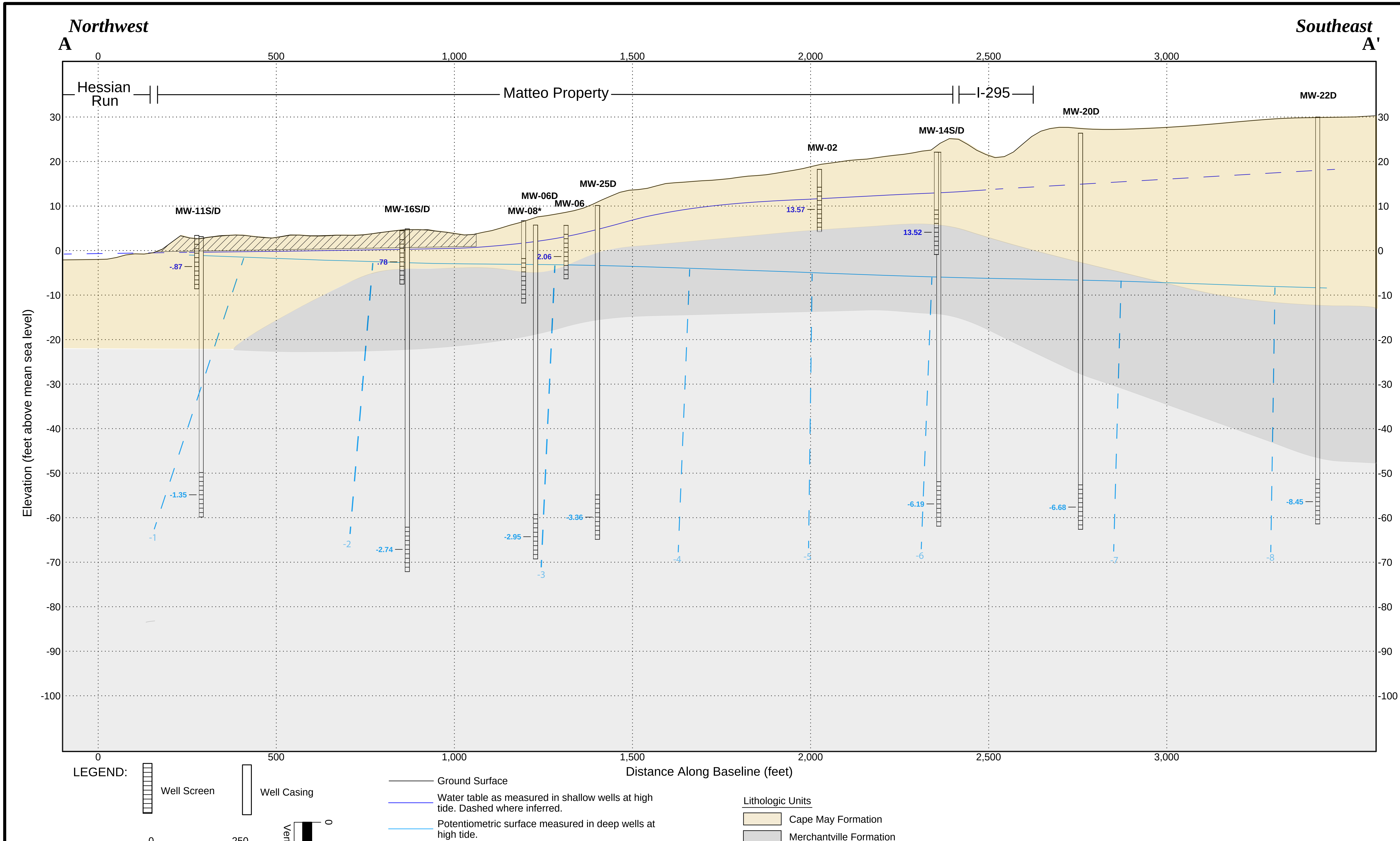


Figure 3-7
Cross Section A-A'
Matteo & Sons, Inc. Site
Thorofare, NJ

STANDARD CROSS SECTION: MATTEO STRETCH MATTEO.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 3/29/12 REV.

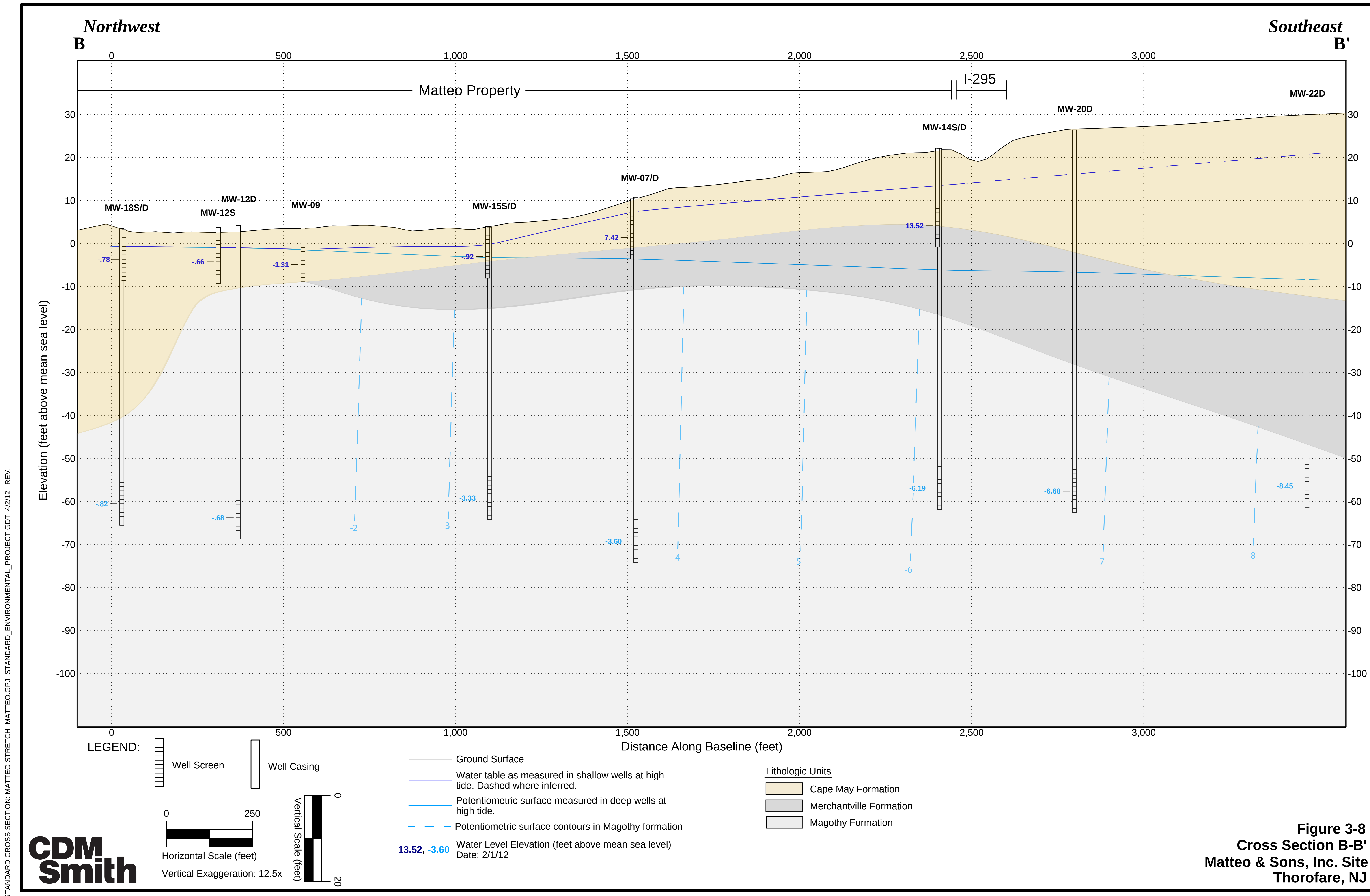


Figure 3-8
Cross Section B-B'
Matteo & Sons, Inc. Site
Thorofare, NJ

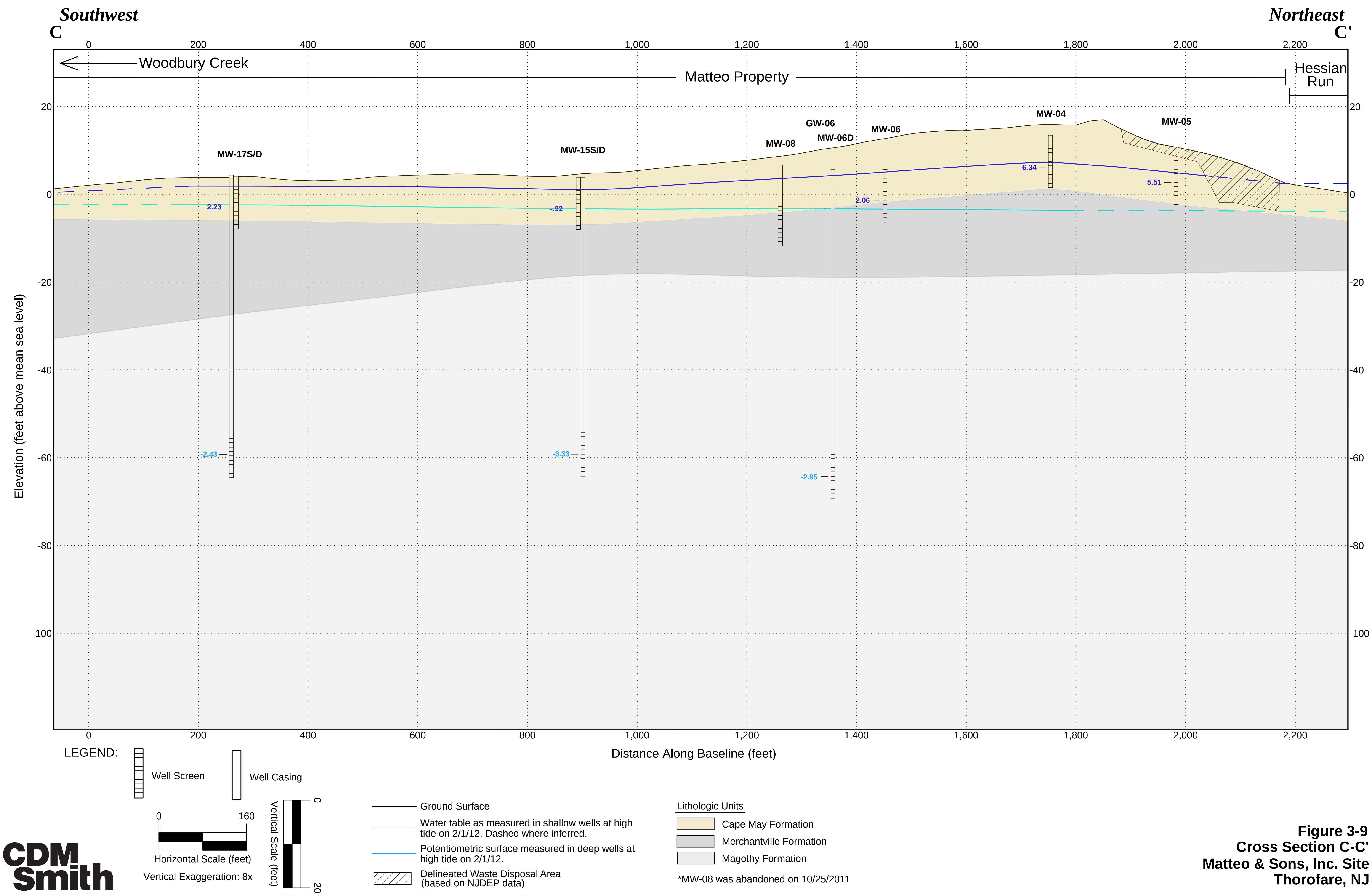


Figure 3-9
Cross Section C-C'
Matteo & Sons, Inc. Site
Thorofare, NJ

STANDARD CROSS SECTION: MATTEO STRETCH MATTEO.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 8/22/12 REV.

Qcm2 CAPE MAY FORMATION (Salisbury and Knapp, 1917) - Fine to coarse sand, minor silt and clay; yellow, brownish-yellow, reddish-yellow, very pale brown, light-gray; minor pebble gravel. Massive to well straisfied. Sand is quartz with a little glauconite and a trace of mica and feldspar. Gravel composition as in unit Qtu. As much as 50 feet thick in the Paulsboro area but generally less than 20 feet thick elesewhere. Unit 2 (Qcm2) (Newell and others, 1995) forms a terrace with a maximum surface elevation of about 30 feet. Fossils, pollen, and amino acid racemization ratios in shells from this unit elsewhere in the delaware estuary and Delaware Bay area indicate that it is an estuarine or fluvial-estuarine deposit of Sangamon age (about 125,000 years ago), when sea level was approximately 30 feet higher than at present in this region (Woolman, 1897; Newell and others, 1995; Lacovara, 1997; Wehmiller, 1997). Unit 1 (Qcm1) is an older estuarine or fluvial-estuarine deposit of uncertain age that forms a terrace with a maximum elevation of about 50 feet. It was laid down during a pre-Sangamon interglacial sea-level highstand and is of early or middle Pleistocene age (Lacovara, 1997; O'Neal and McGeary, 2002). Salisbury and Knapp (1917) included fluvial terrace deposits within the Cape May Formation; here they are mapped separately as units Qtl and Qtu.

Qal ALLUVIUM - Sand, silt, mior clay; brown, yellowish-brown, gray; and pebble gravel. Contains variable amounts of organic matter. Sand and silt is massive to weakly stratified. Gravel occcurs in massive to weakly stratified beds generally less than 2 feet think. Sand is chiefly quartz with some glauconite and ironstone. Gravle is chielfy white, gray, and yellow quartz and quartzite, minor reddish-brown ironstone, and a trace of gray chert. In deposits beneath the Delaware River, gravel also includes gray and red sandstone and mudstine, gray gneiss, and purple-red conglomerate. As much as 40 feet thick beneath the Delaware River, as much as 15 feet thick (estimated) elsewhere. Glauconite is more abundant than in older surfical deposits because streams had incised into the glauconite-rich Navesink and Hornerstown formations during deposition of this unit. In tributary valleys, forms terraces with surfaces 5 to 15 feet above modern flood plains. Beneath the Delaware River, forms eroded terrace remnants, now covered by estuarine deposits, with top surfaces about -10 feet in elevation

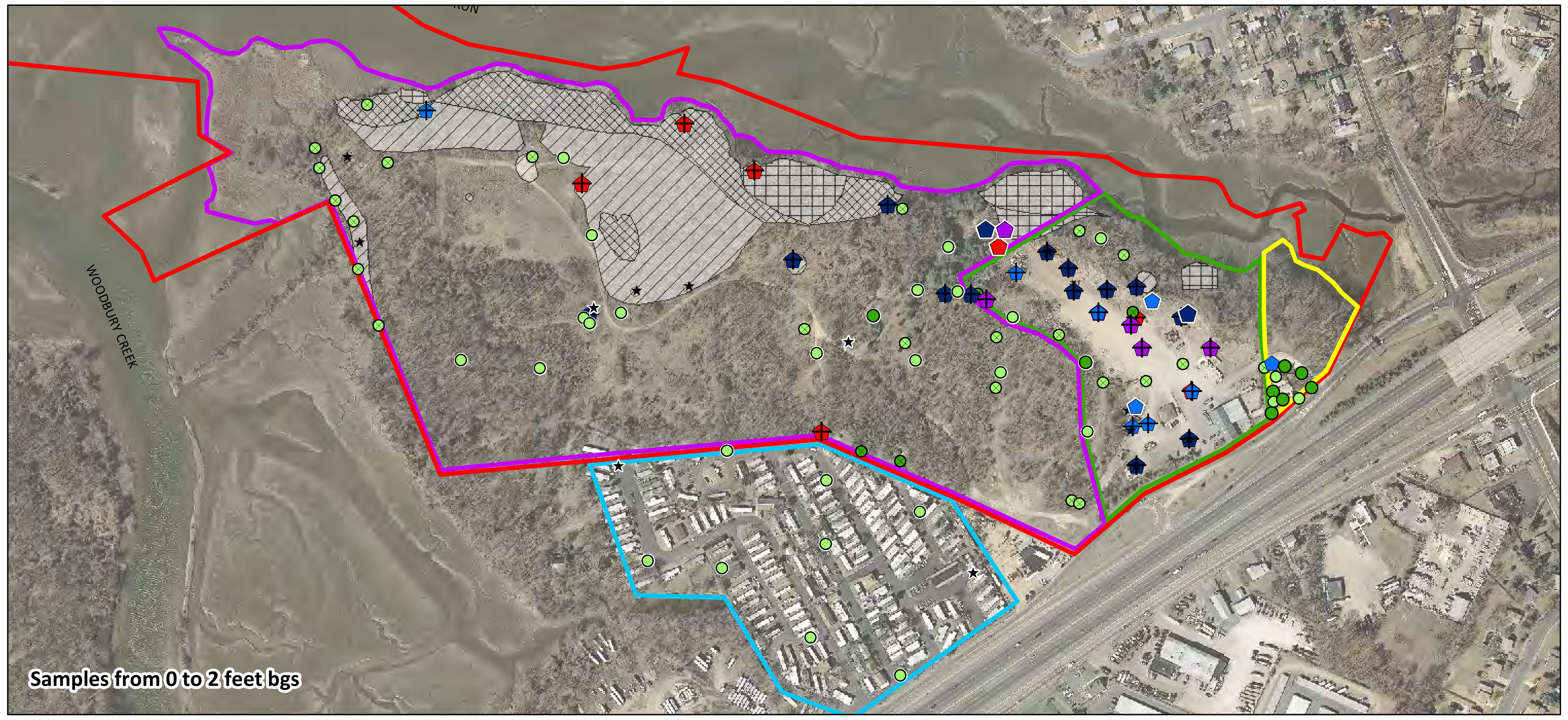
ARTIFICAL FILL - Sand, silt, gravel, clay; gray to brown; demolition debris (concreete, brick, wood, metal, etc.), cinders, ash, slag, glass. Massive to weakly stratified. As much as 40 feet thick. In highway and railroad embankments, filled marshes and floodplains, and dredge-spoil disposal areas along the Delaware River. Many small areas of fill, particularly along streams in urban areas, are not mapped.

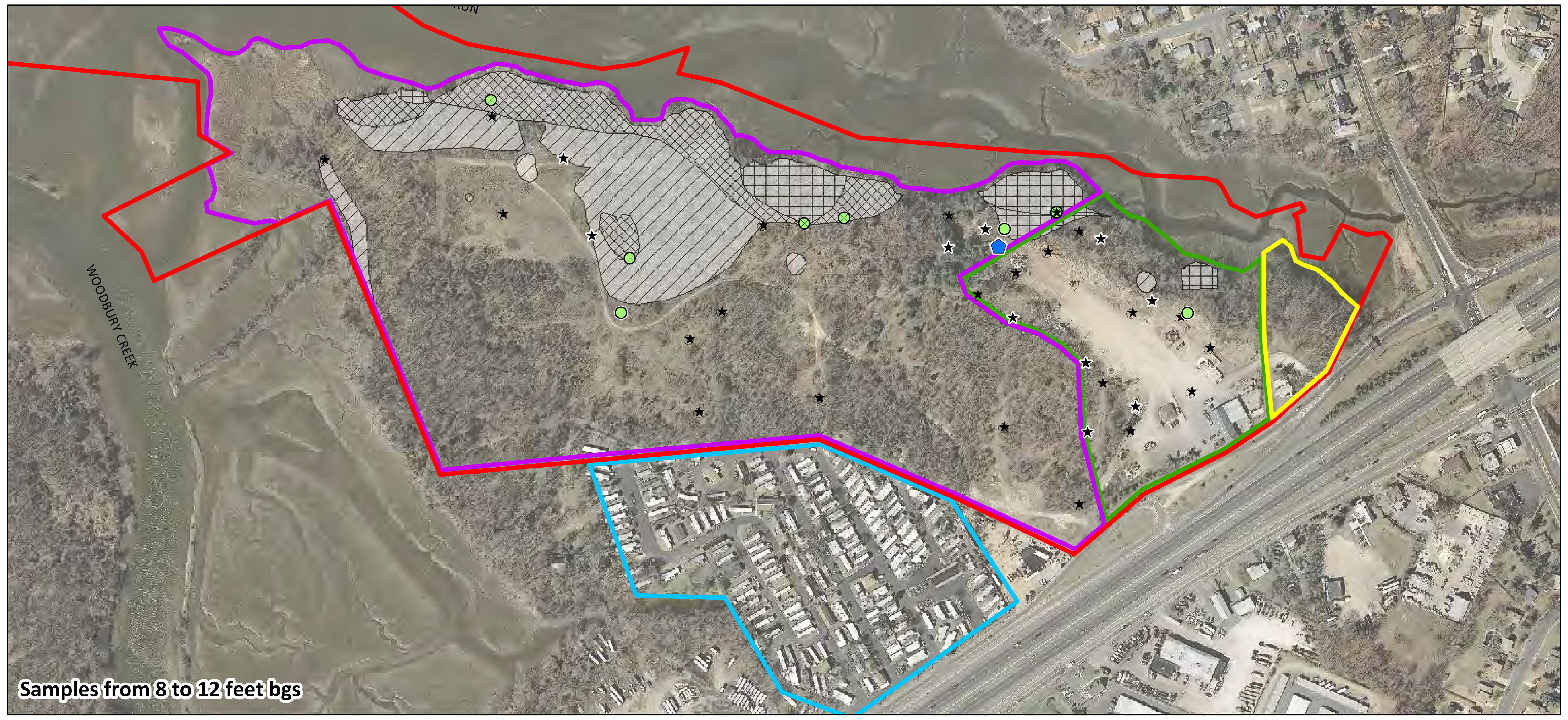
Qm SALT-MARSH AND ESTUARINE DEPOSITS - Silt, sand peat, clay; brown, dark-brown, gray, black; and minor pebble gravel. Contain abundant organic matter. As much as 90 feet think beneath the Delaware River; 40 feet thick elsewhere. Deposited in modern salt marshes, tidal flats, and tidal channels during Holocene sea-level rise, chiefly within the past 10,000 years. Where covered by artificial fill, the extent of the Deposits is based in part on the position of shorelines and salt marshes shown on topographic manuscript map sheets 68 and 69 (N.J. Geological Survey, 1906, scale 1:21,320)

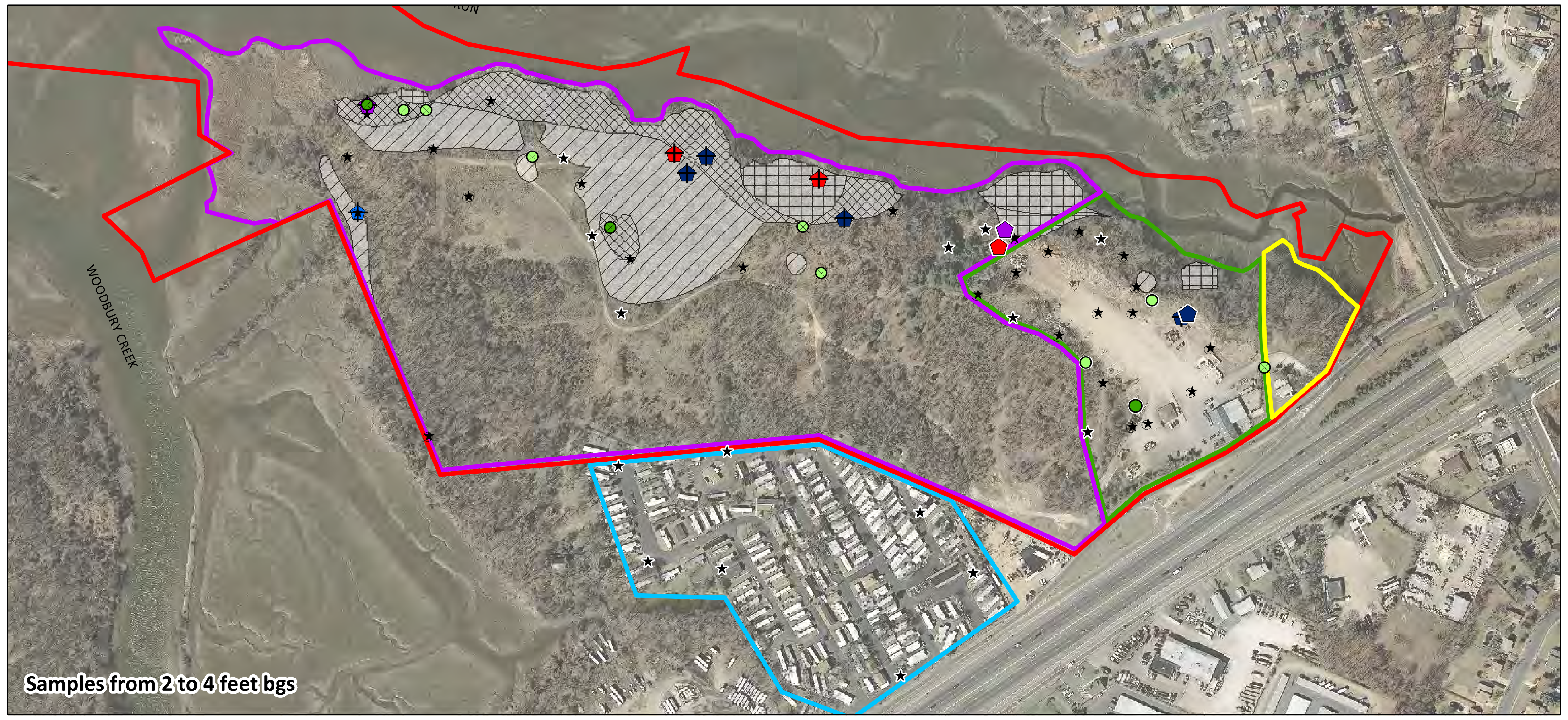
N

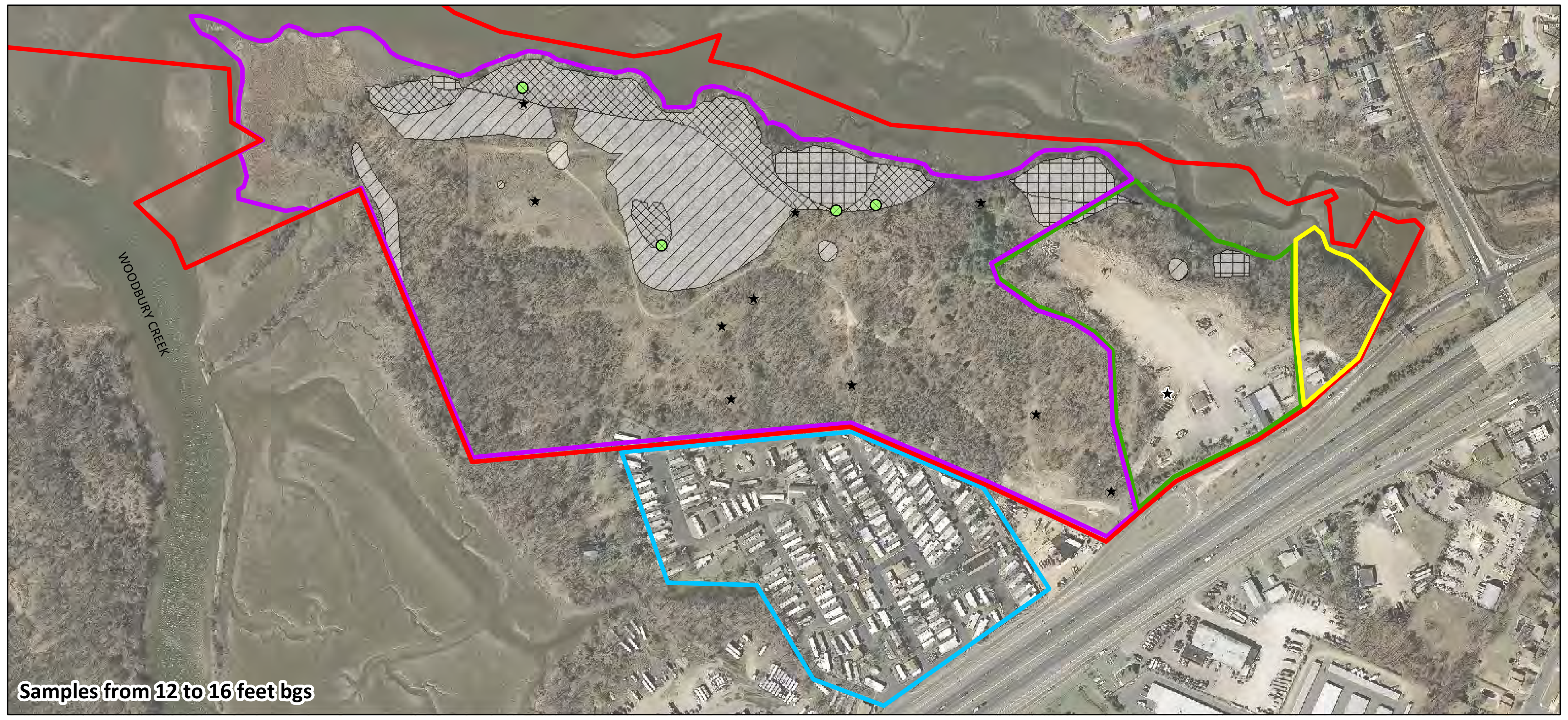
Figure 3-10
Surficial Geology
Matteo & Sons, Inc. Site
Thorofare, NJ

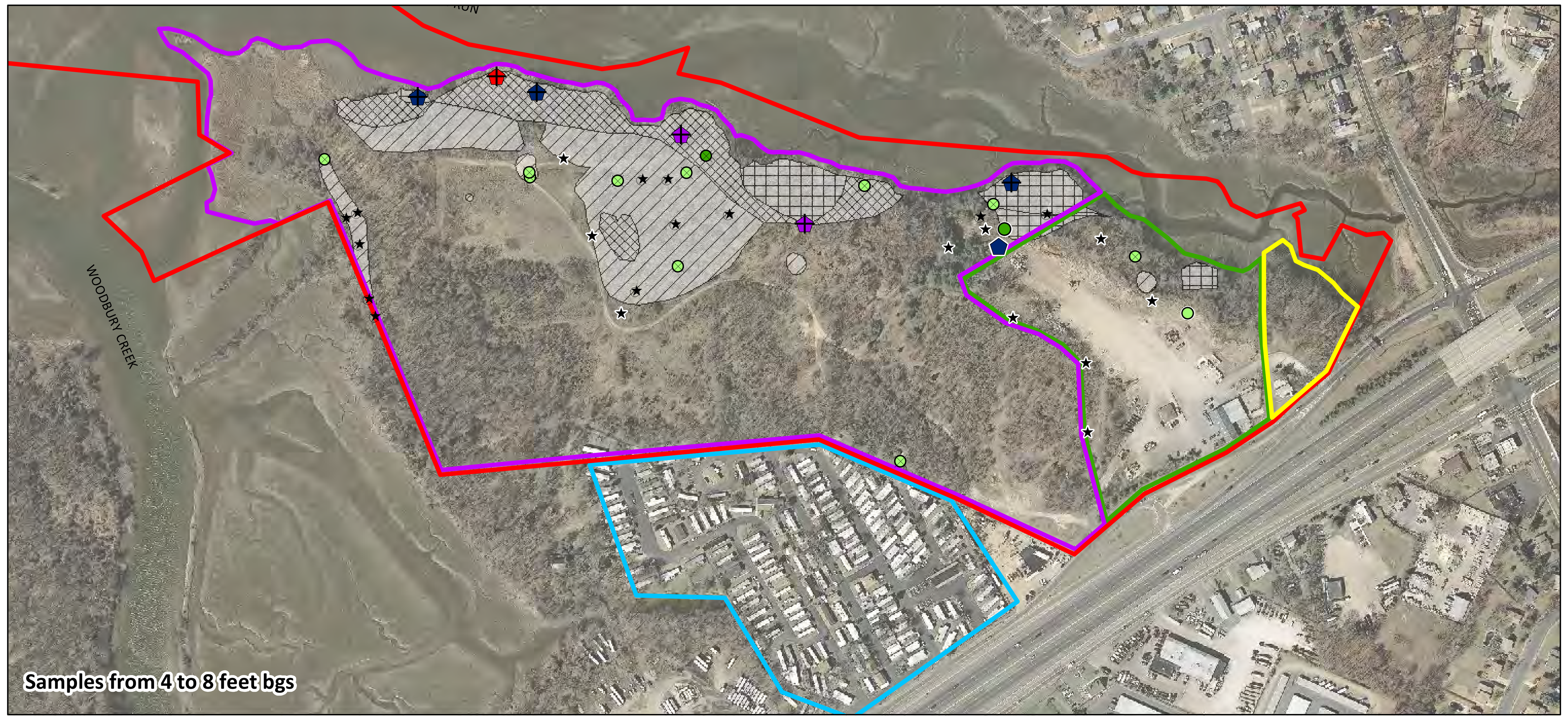
CDM Smith











RI Lead Concentrations mg/kg	NJDEP Lead Concentrations mg/kg
<11	<11
11 - 128	11 - 128
128 - 400	128 - 400
400 - 800	400 - 800
800 - 5,000	800 - 5,000
5,000 - 10,000	5,000 - 10,000
>10,000	>10,000

Site Areas

- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Rental Home Area
- Willow Woods Property

Delineated Waste Disposal Areas

- Batteries and Waste
- Batteries
- Waste

Soil Screening Criteria

EPA ECOSSLss - 11 mg/kg (ECO)
Site Background - 128 mg/kg
EPA RSL - 400 mg/kg (Human Health)
NJDEP RSDCSC - 400 mg/kg (Human Health)
NJDEP NRSDCSC - 800 mg/kg (Human Health)

Notes

1. Soil sampling results are presented for both RI (2012,2015) and NJDEP RI (2005) Sampling.
2. A removal action was performed on the Willow Woods property, the pre-removal results have not been incorporated.
3. Historic sample depths may not be representative of current conditions, particularly in the Scrapyard area where 2-3 feet of clean gravel have been added.

Acronyms

EPA - Environmental Protection Agency
EPA ECOSSL - EPA ecological soil screening levels
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP IGWSSC - NJDEP Impact to Groundwater Soil Screening Criteria
NJDEP RSDCSC - NJDEP Residential Soil Direct Contact Screening Criteria
NJDEP NRSDCSC - NJDEP Non-Residential Soil Direct Contact Screening Criteria

N

0 150 300 600 Feet

1 inch = 300 feet

Figure 4-1
Lead Concentrations in Soil at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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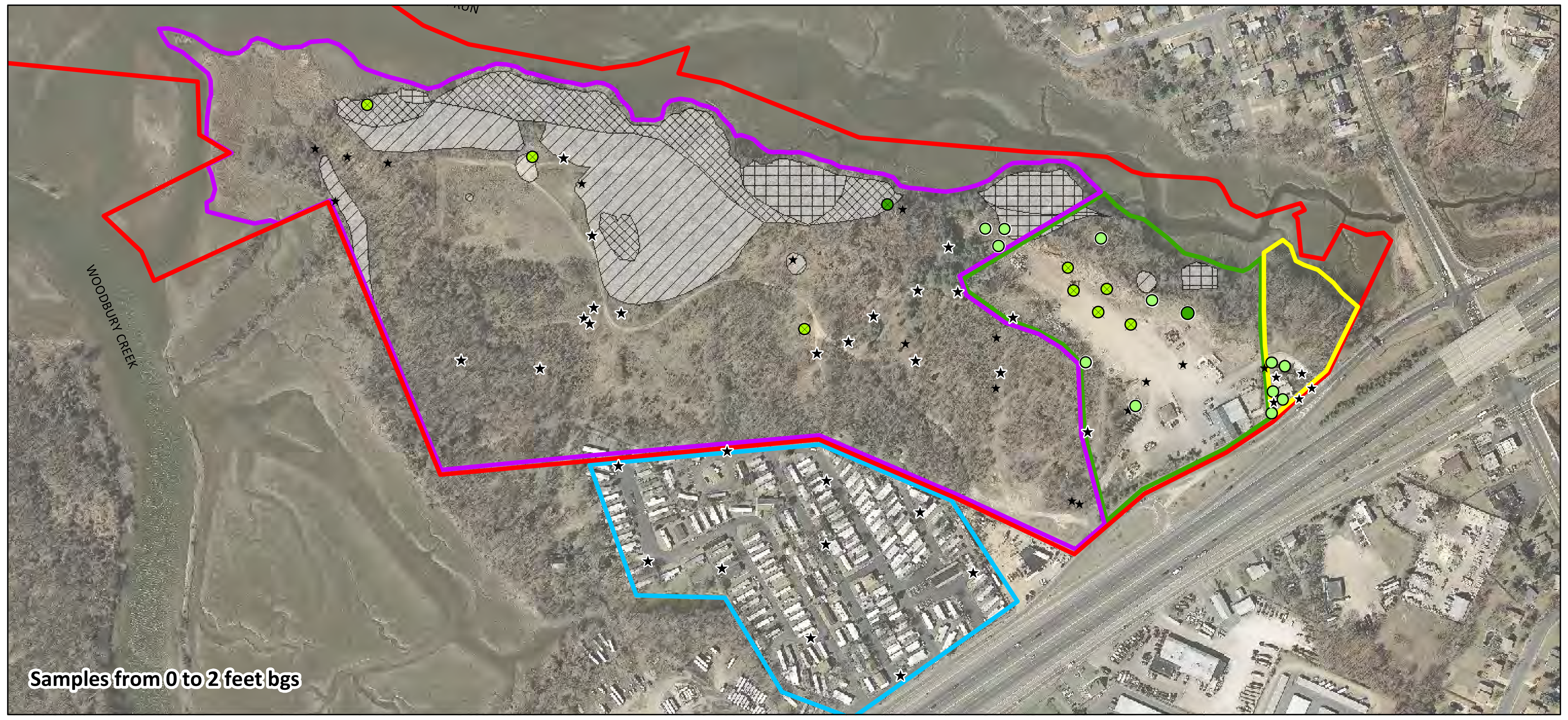
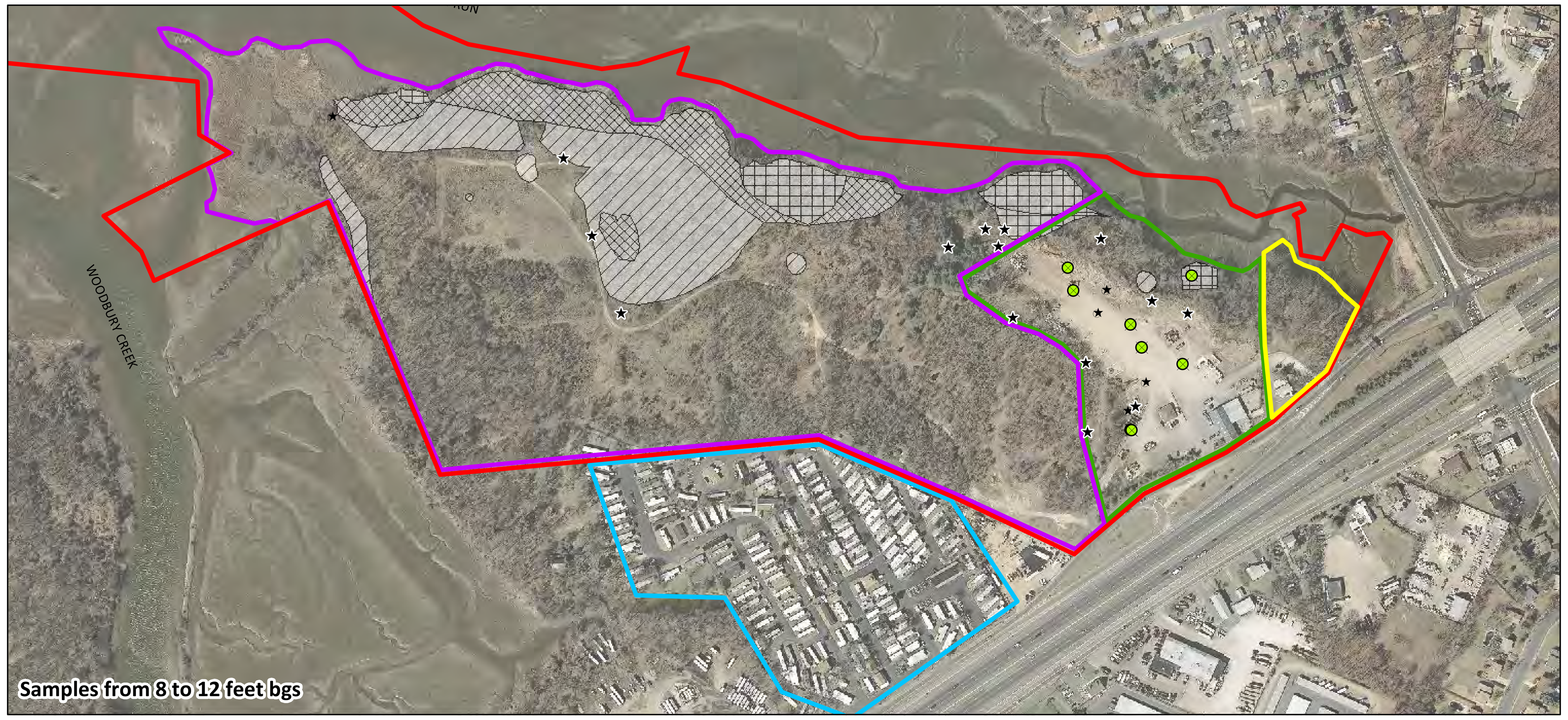
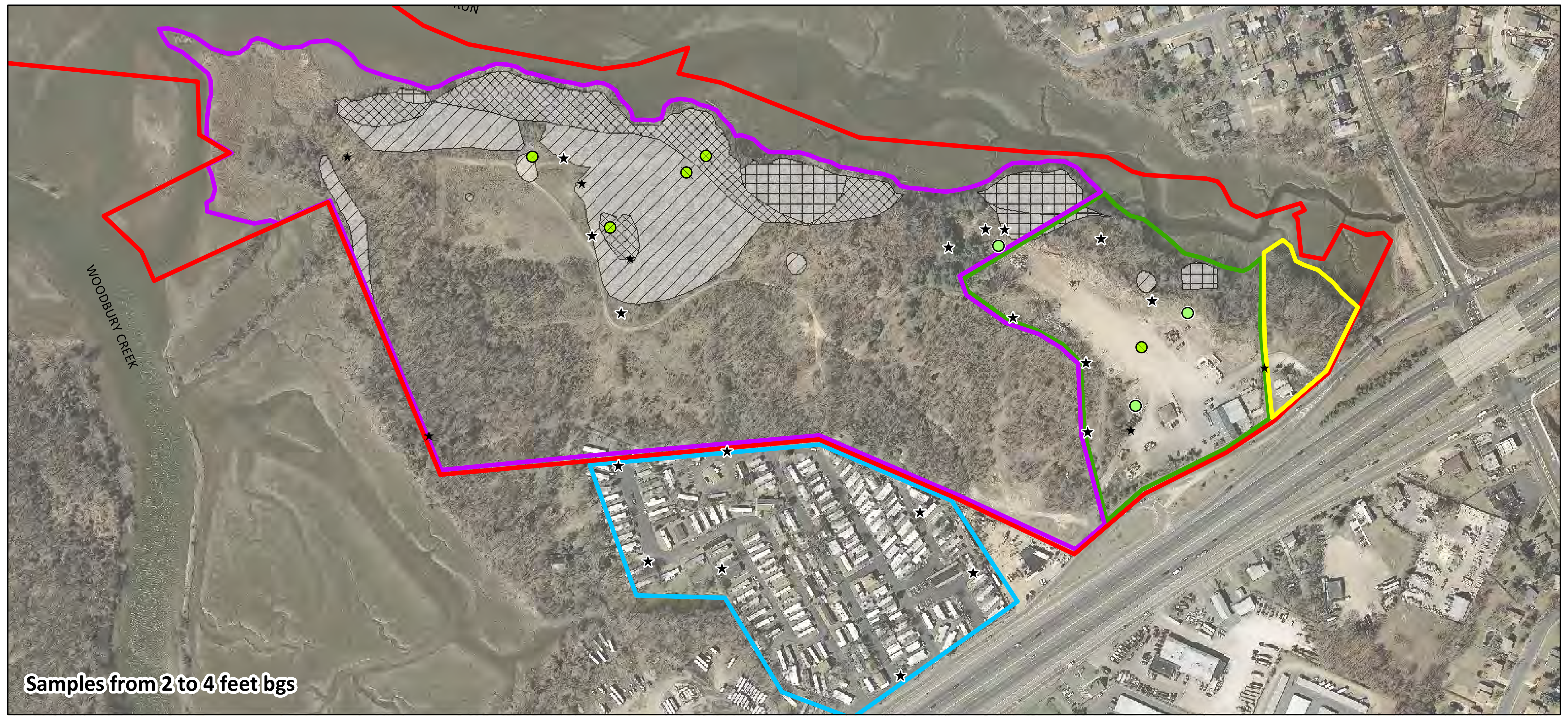
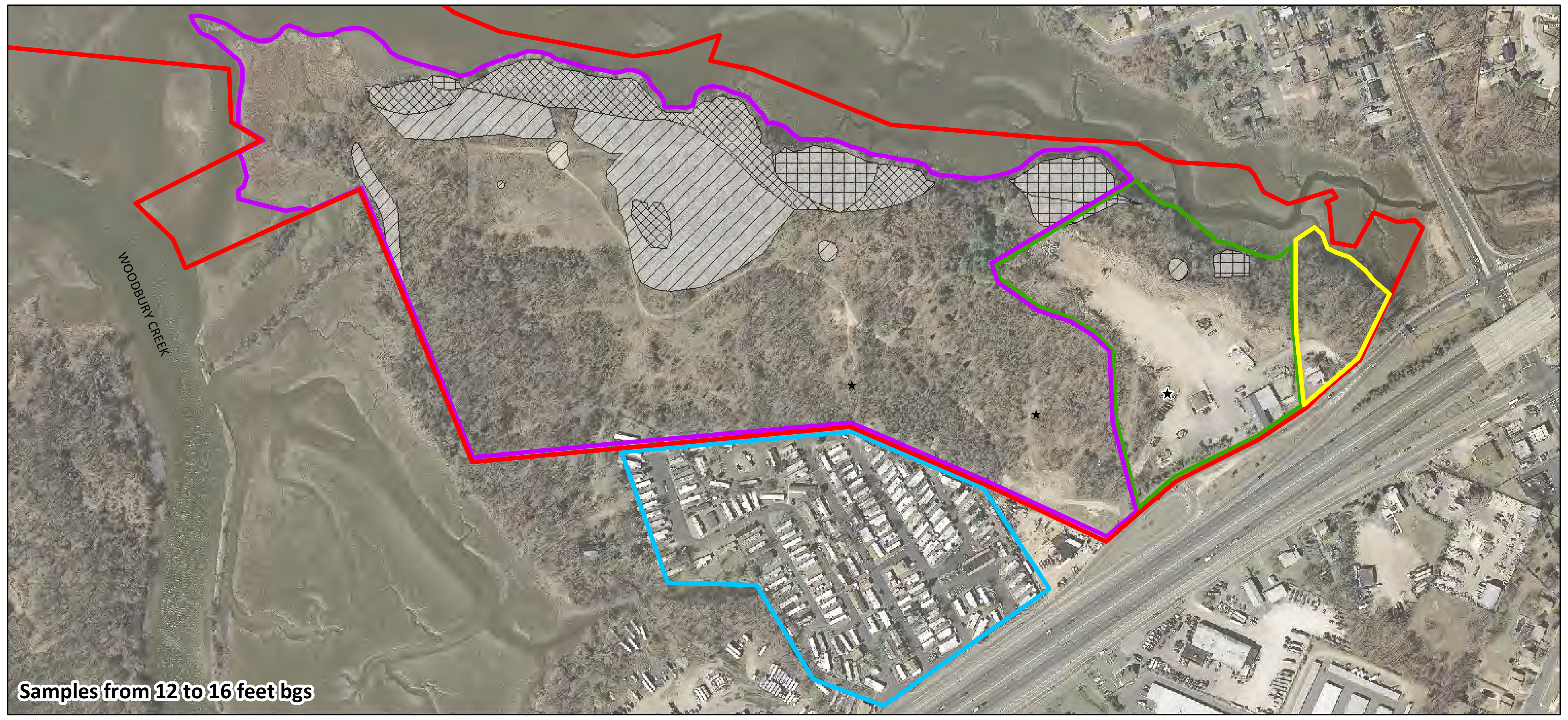
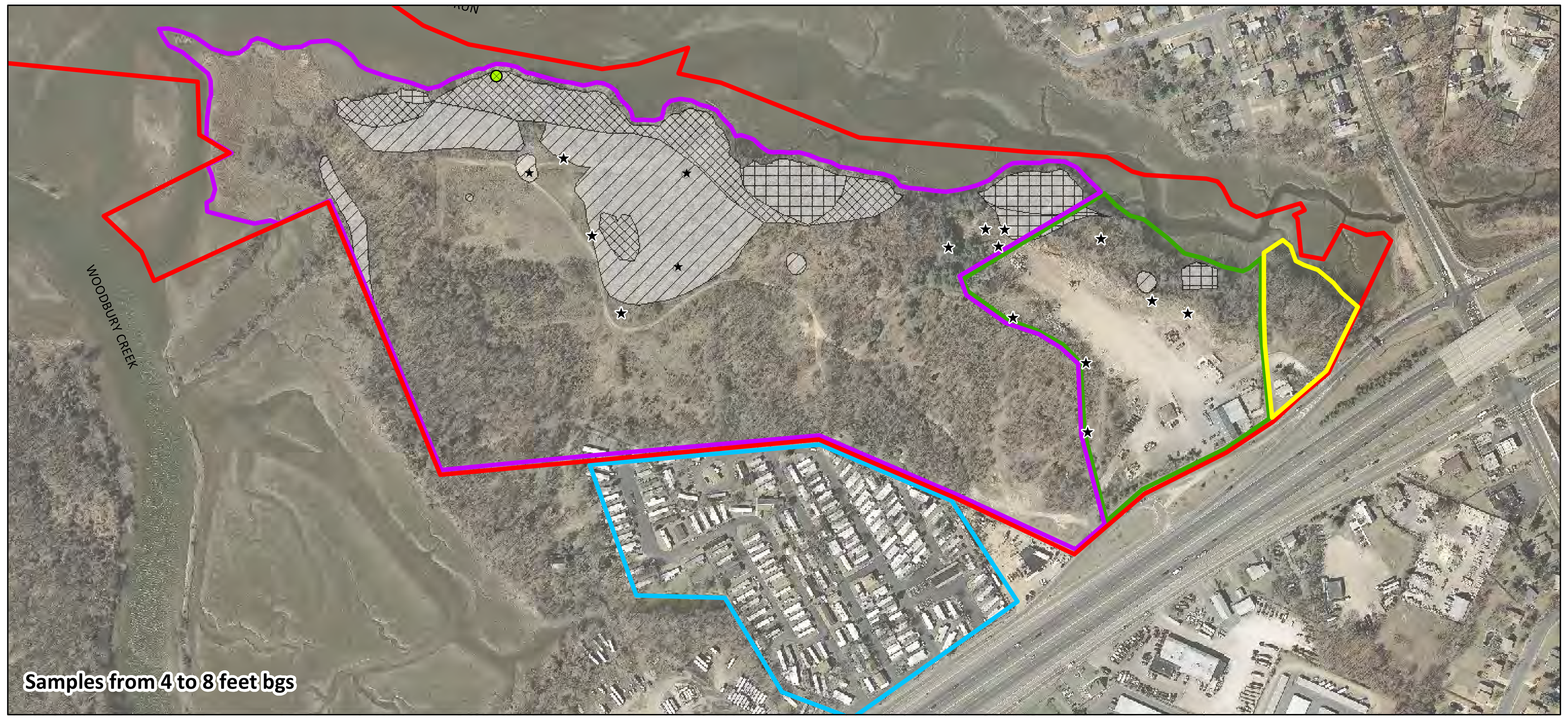
Figure 4-2
Antimony Concentrations in Soil at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ











RI Copper Concentrations mg/kg	NJDEP Copper Concentrations mg/kg
<28	<28
28 - 3,100	28 - 3,100
3,100 - 11,000	3,100 - 11,000
11,000 - 45,000	11,000 - 45,000
>45,000	>45,000

Site Areas
- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Rental Home Area
- Willow Woods Property

Delineated Waste Disposal Areas
- Batteries and Waste
- Batteries
- Waste

Soil Screening Criteria
EPA ECOSSLs - 28 mg/kg (ECO)
EPA RSL - 3,100 mg/kg (Human Health)
NJDEP RSDCSC - 3,100 mg/kg (Human Health)
NJDEP IGWSSC - 11,000 mg/kg
NJDEP NRSDCSC - 45,000 mg/kg (Human Health)

Notes
1. Soil sampling results are presented for both RI (2012,2015) and NJDEP RI (2005) Sampling.
2. A removal action was performed on the Willow Woods property, the pre-removal results have not been incorporated.
3. Historic sample depths may not be representative of current conditions, particularly in the Scrapyard area where 2-3 feet of clean gravel have been added.

Acronyms
EPA - Environmental Protection Agency
EPA ECOSSL - EPA ecological soil screening levels
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP IGWSSC - NJDEP Impact to Groundwater Soil Screening Criteria
NJDEP RSDCSC - NJDEP Residential Soil Direct Contact Screening Criteria
NJDEP NRSDCSC - NJDEP Non-Residential Soil Direct Contact Screening Criteria

N

0 150 300 600 Feet

1 inch = 300 feet

Figure 4-3
Copper Concentrations in Soil at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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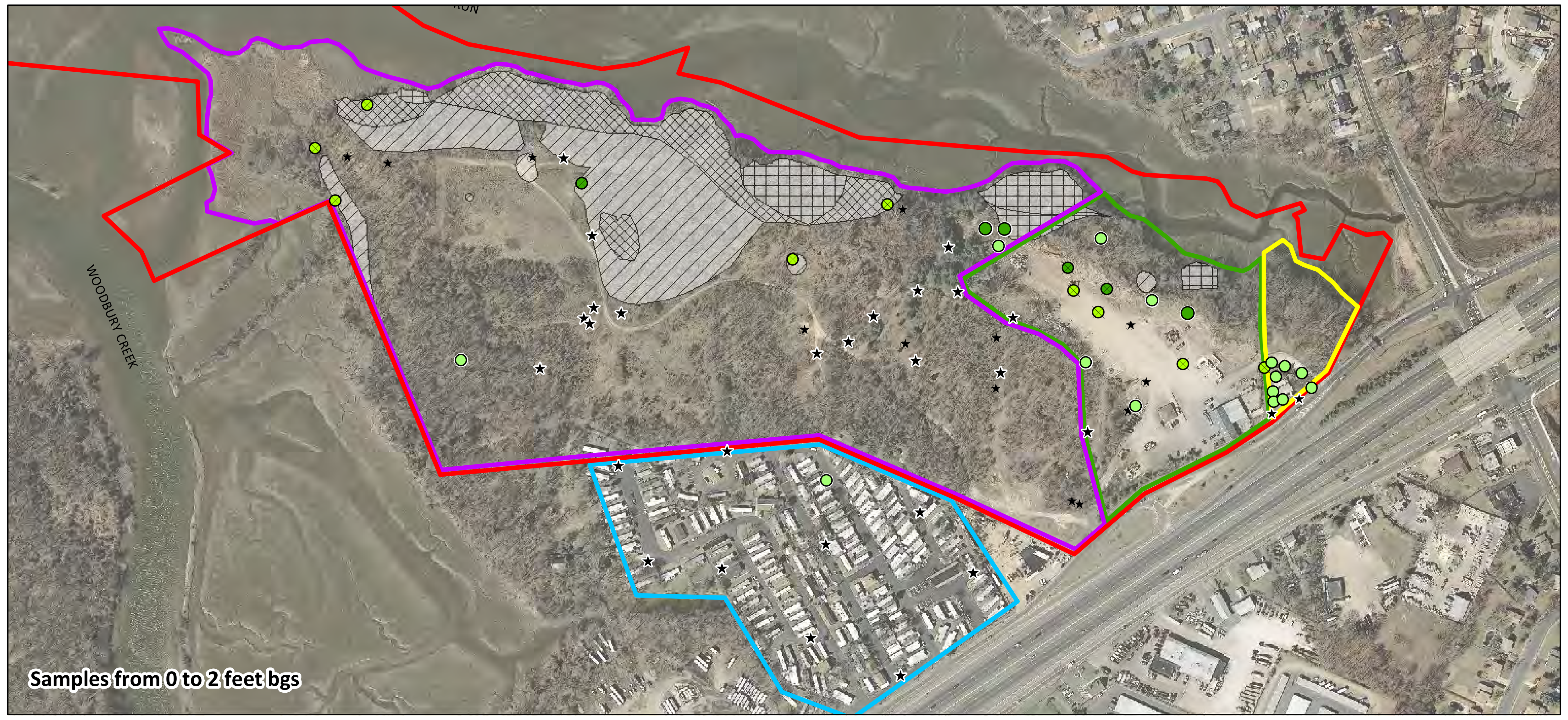

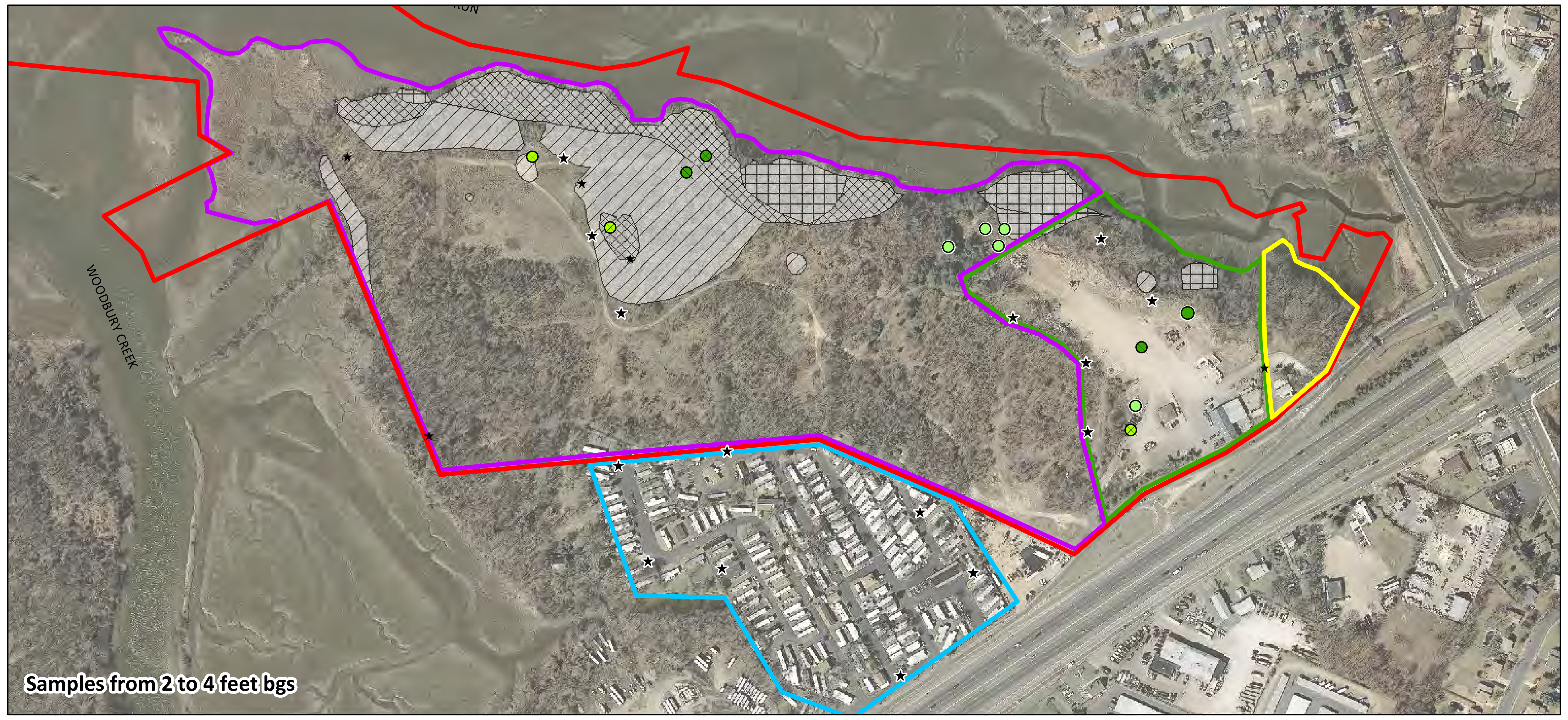

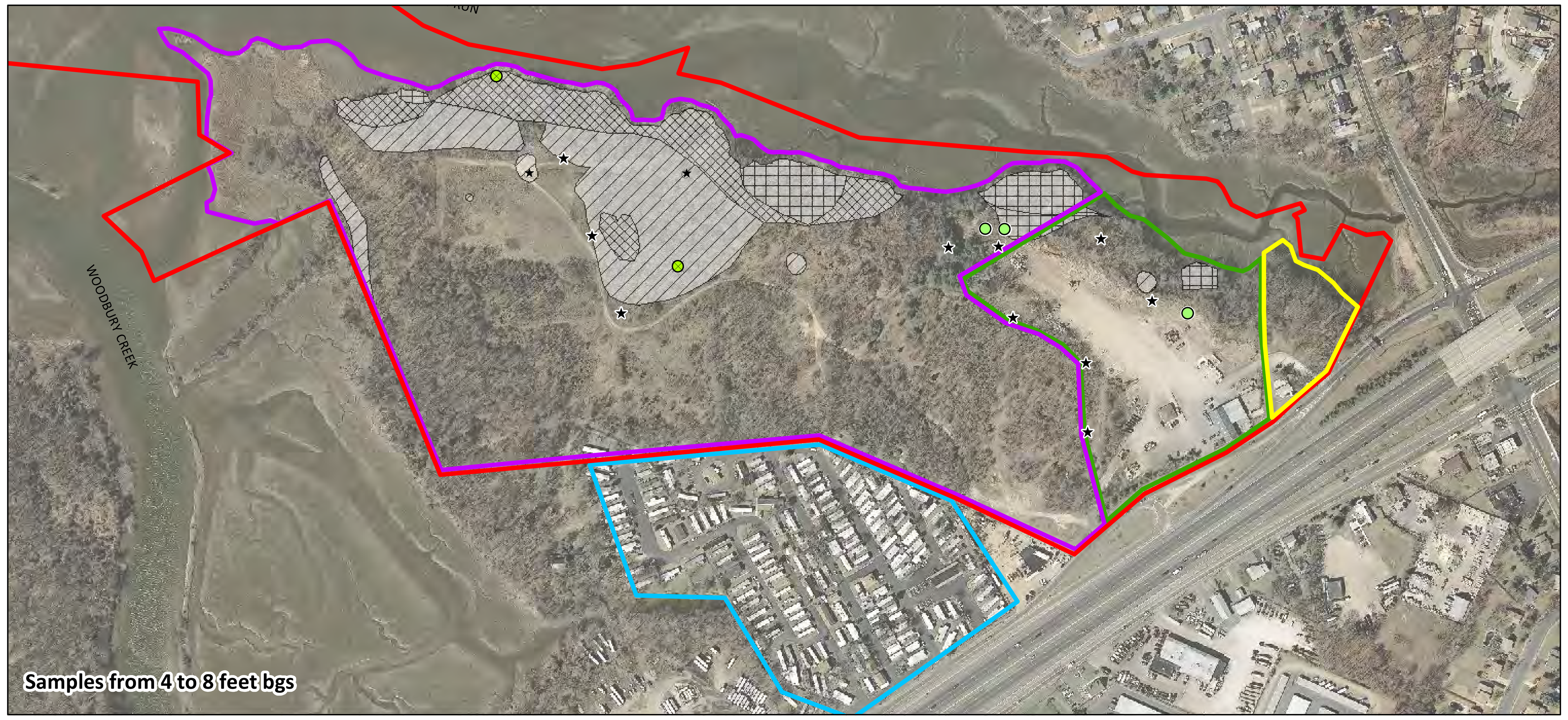

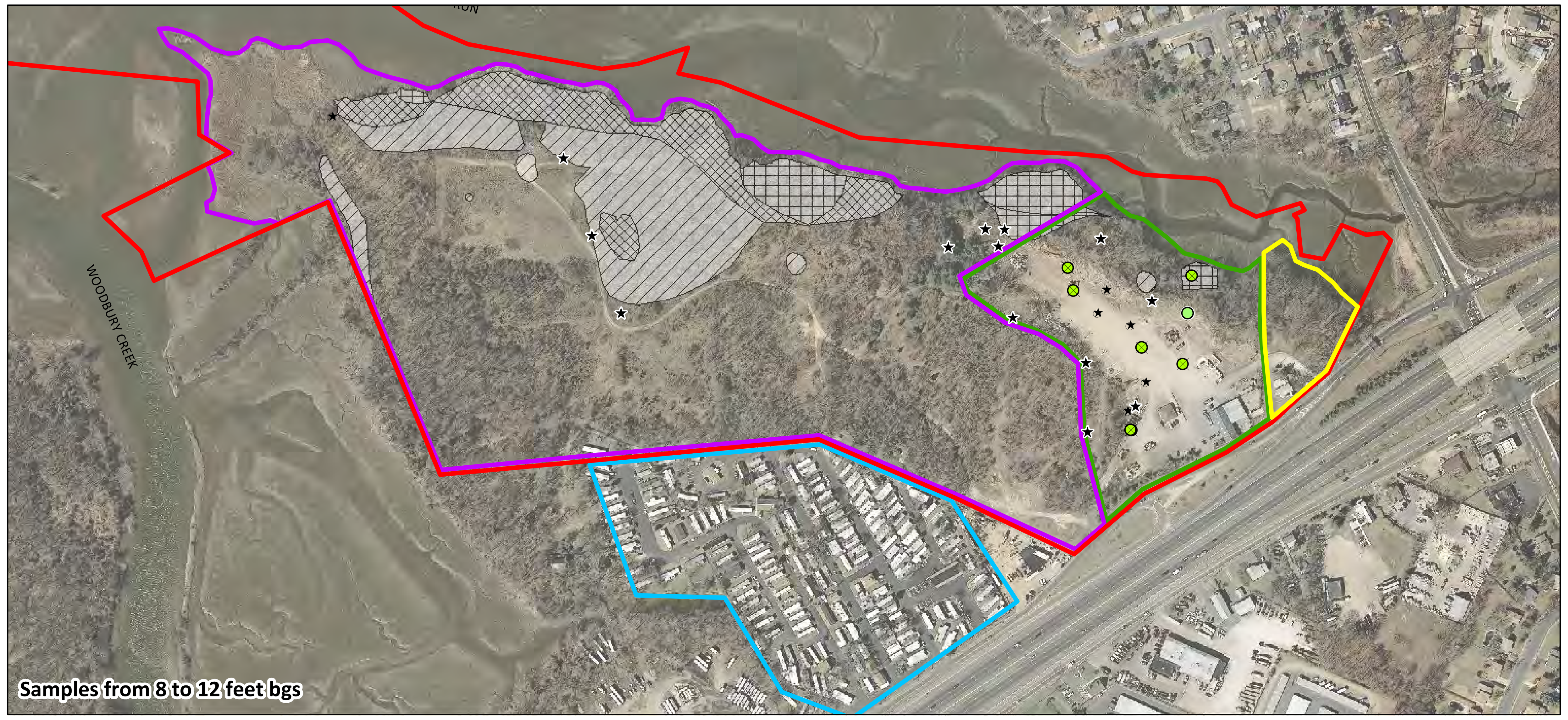

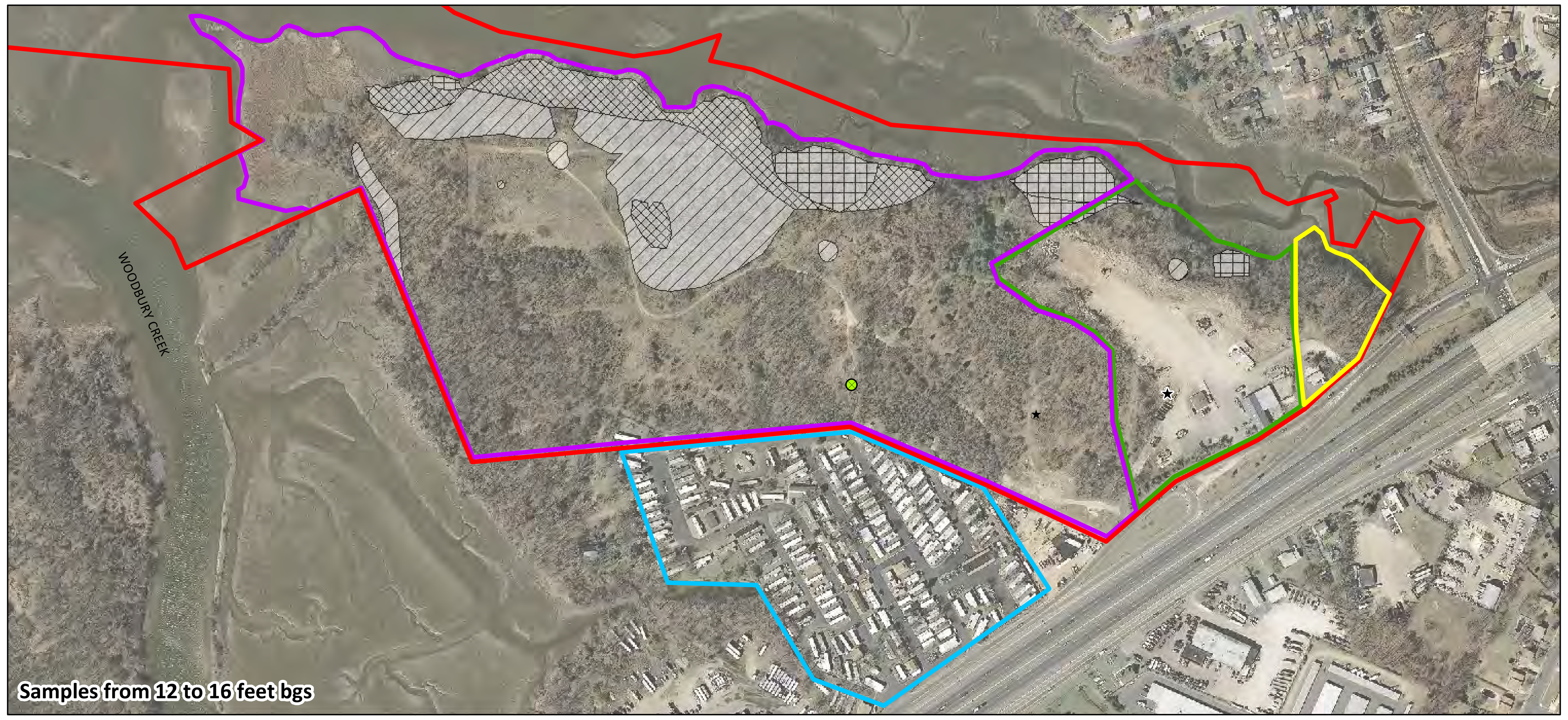

RI Zinc Concentrations mg/kg	NJDEP Zinc Concentrations mg/kg
<46	<46
46 - 930	46 - 930
930 - 23,000	930 - 23,000
23,000 - 110,000	23,000 - 110,000
>110,000	>110,000

Site Areas
- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Rental Home Area
- Willow Woods Property

Delineated Waste Disposal Areas
- Batteries and Waste
- Batteries
- Waste

Soil Screening Criteria
EPA ECOSSLs - 46 mg/kg (ECO)
NJDEP IGWSSC - 930 mg/kg
EPA RSL - 23,000 mg/kg (Human Health)
NJDEP RSDCSC - 23,000 mg/kg (Human Health)
NJDEP NRSDCSC - 110,000 mg/kg (Human Health)

Notes
1. Soil sampling results are presented for both RI (2012,2015) and NJDEP RI (2005) Sampling.
2. A removal action was performed on the Willow Woods property, the pre-removal results have not been incorporated.
3. Historic sample depths may not be representative of current conditions, particularly in the Scrapyard area where 2-3 feet of clean gravel have been added.

Acronyms
EPA - Environmental Protection Agency
EPA ECOSSL - EPA ecological soil screening levels
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP IGWSSC - NJDEP Impact to Groundwater Soil Screening Criteria
NJDEP RSDCSC - NJDEP Residential Soil Direct Contact Screening Criteria
NJDEP NRSDCSC - NJDEP Non-Residential Soil Direct Contact Screening Criteria

N

0 150 300 600 Feet

1 inch = 300 feet

Figure 4-4
Zinc Concentrations in Soil at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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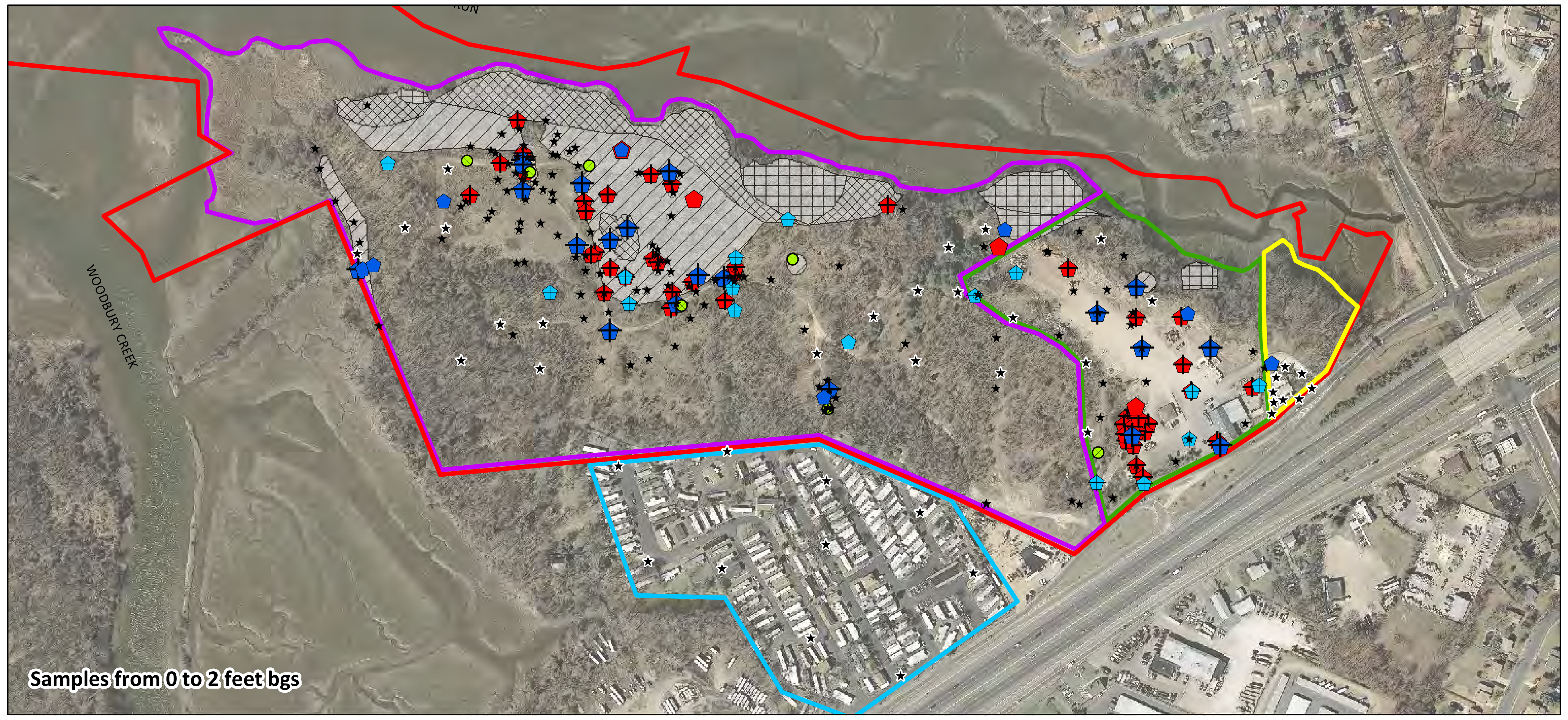

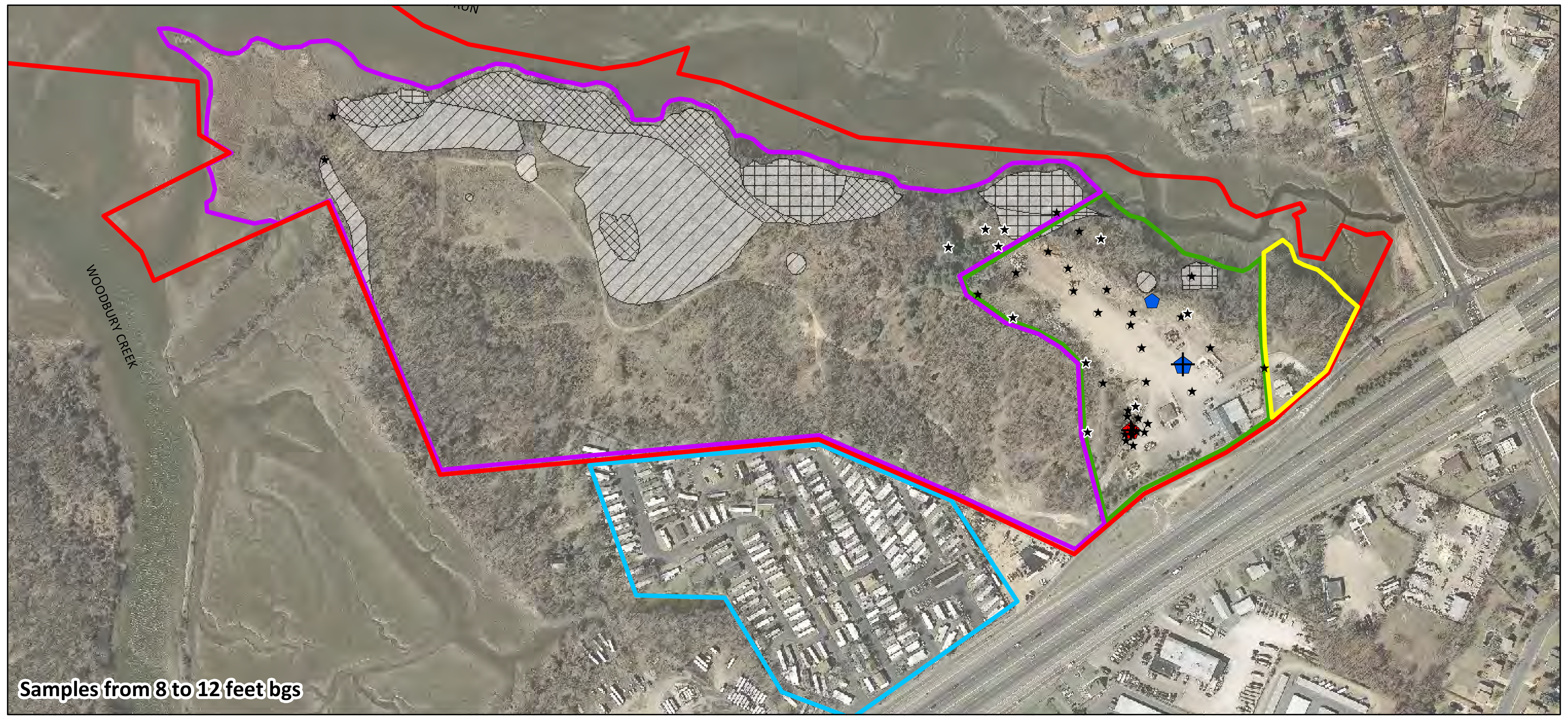

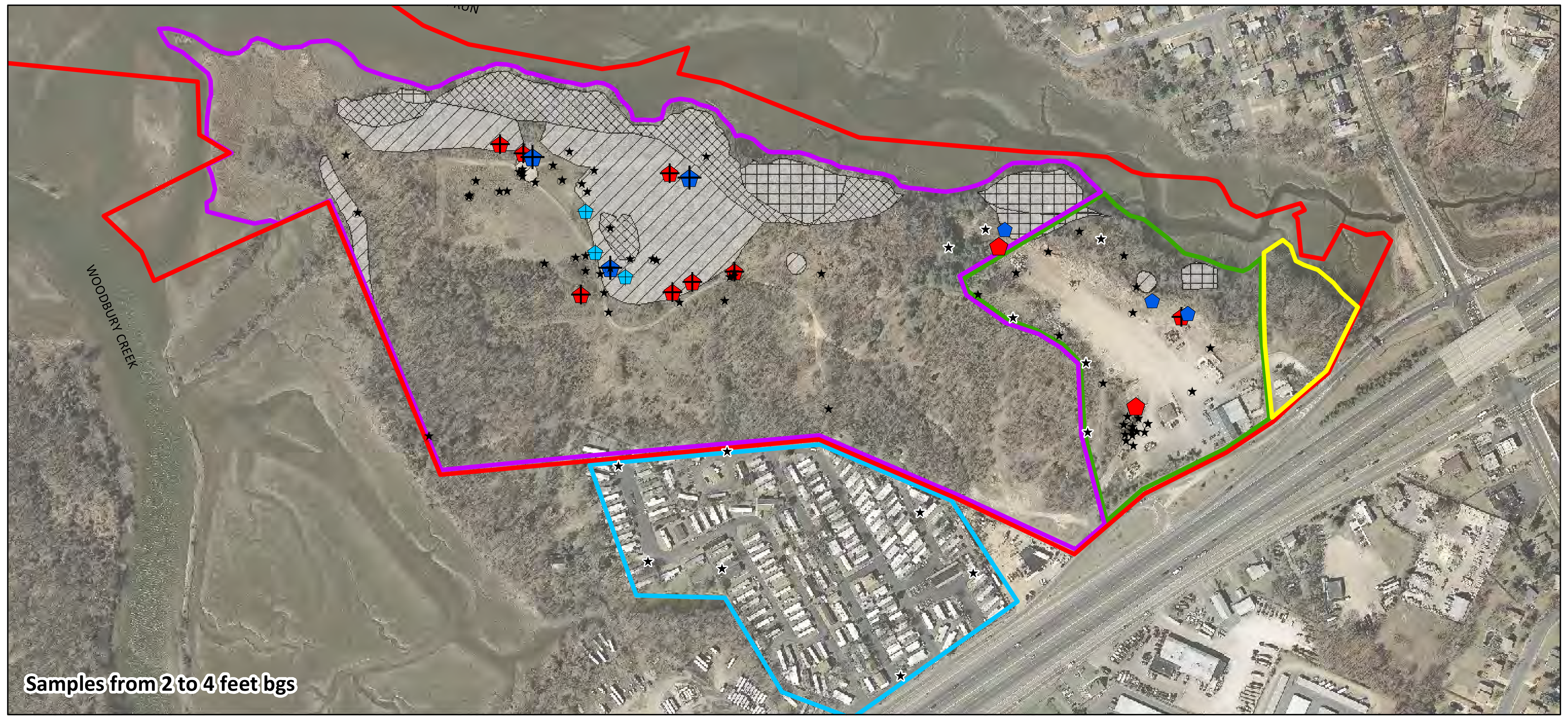

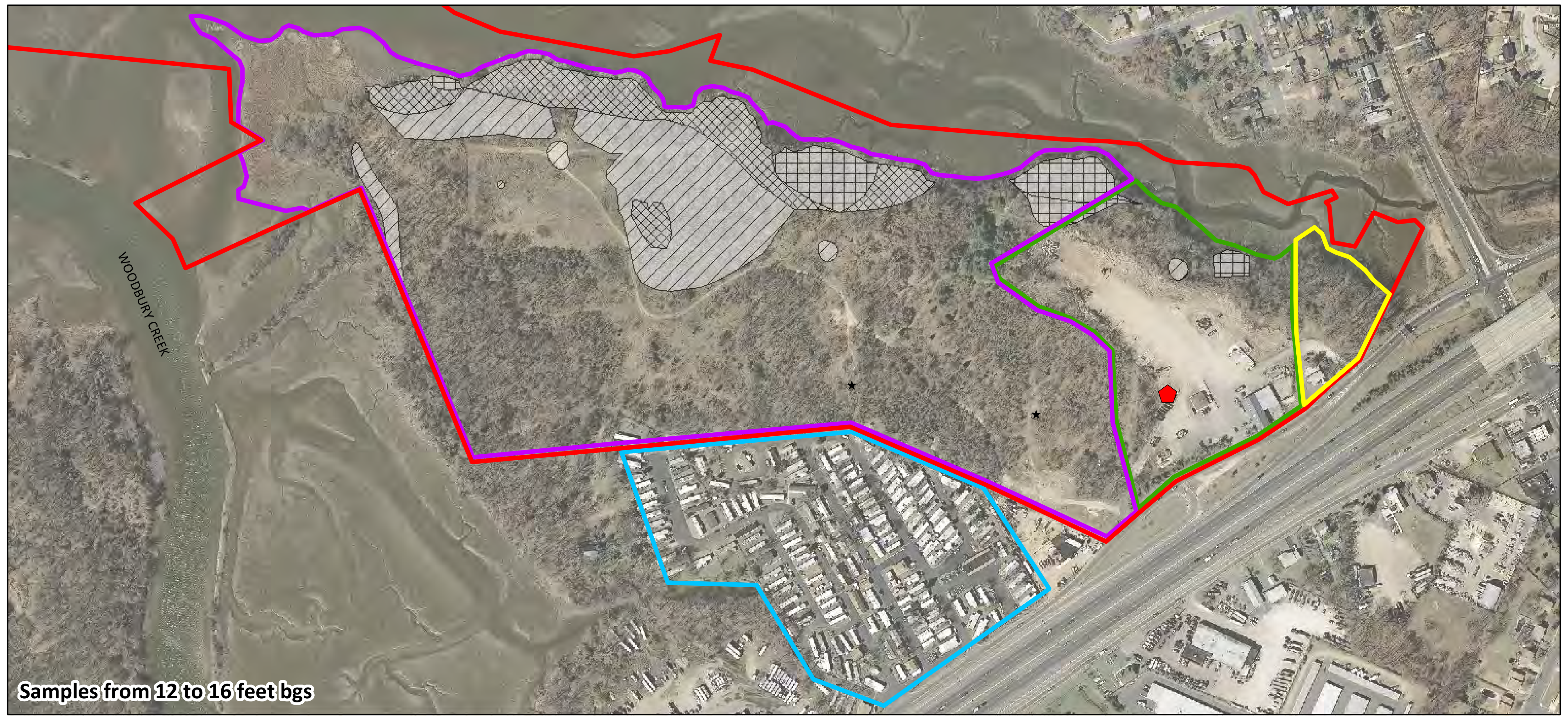

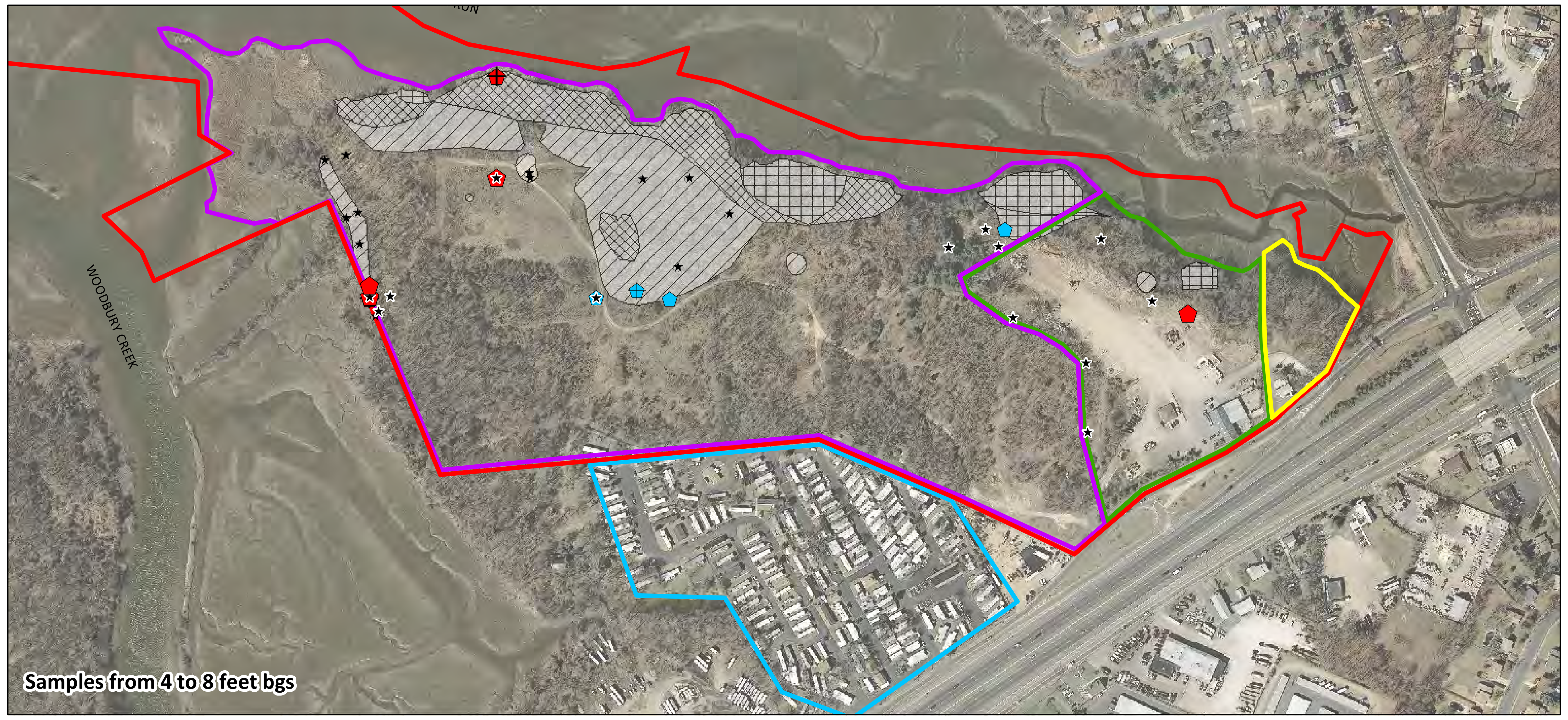

RI Total Aroclor Concentrations
ug/kg
- <200
- 200 - 240
- 240 - 371
- 371 - 1,000
- >1,000

NJDEP Total Aroclor Concentrations
ug/kg
- <200
- 200 - 240
- 240 - 371
- 371 - 1,000
- >1,000

- Matteo Property
- Scrapyard Area
- Open Field/ Waste Disposal Area
- Willow Woods Property

Delineated Waste Disposal Areas
- Batteries and Waste
- Batteries
- Waste

Soil Screening Criteria
NJDEP RSDCSC - 200 ug/kg (Human Health)
NJDEP IGWSSC - 200 ug/kg
EPA RSL - 240 ug/kg (Human Health)
ECO PRGs - 371 ug/kg (ECO)
NJDEP NRSDCSC - 1,000 ug/kg (Human Health)

Notes
1. Soil sampling results are presented for both RI (2012,2015) and NJDEP RI (2005) Sampling.
2. NJDEP RI data is not complete and will be revised when the data set has been incorporated into the site database.
3. A removal action was performed on the Willow Woods property, the pre-removal results have not been incorporated.
4. Historic sample depths may not be representative of current conditions, particularly in the Scrapyard area where 2-3 feet of clean gravel have been added.

Acronyms
EPA - Environmental Potection Agency
EPA ECOSSL - EPA ecological soil screening levels
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP IGWSSC - NJDEP Impact to Groundwater Soil Screening Criteria
NJDEP RSDCSC - NJDEP Residential Soil Direct Contact Screening Criteria
NJDEP NRSDCSC - NJDEP Non-Residential Soil Direct Contact Screening Criteria

N

0 150 300 600 Feet

1 inch = 300 feet

Figure 4-6
Total Aroclor Concentrations in Soil at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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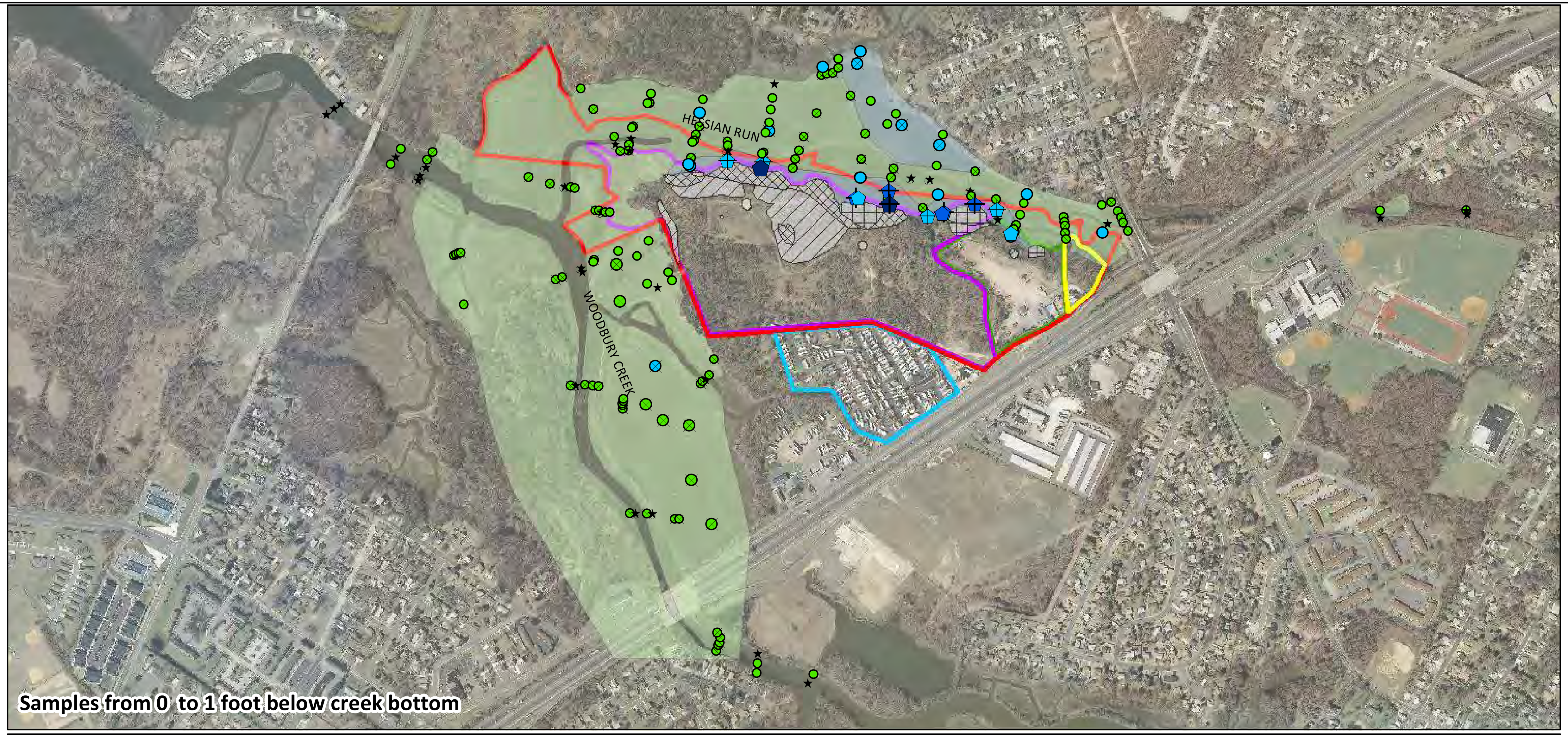

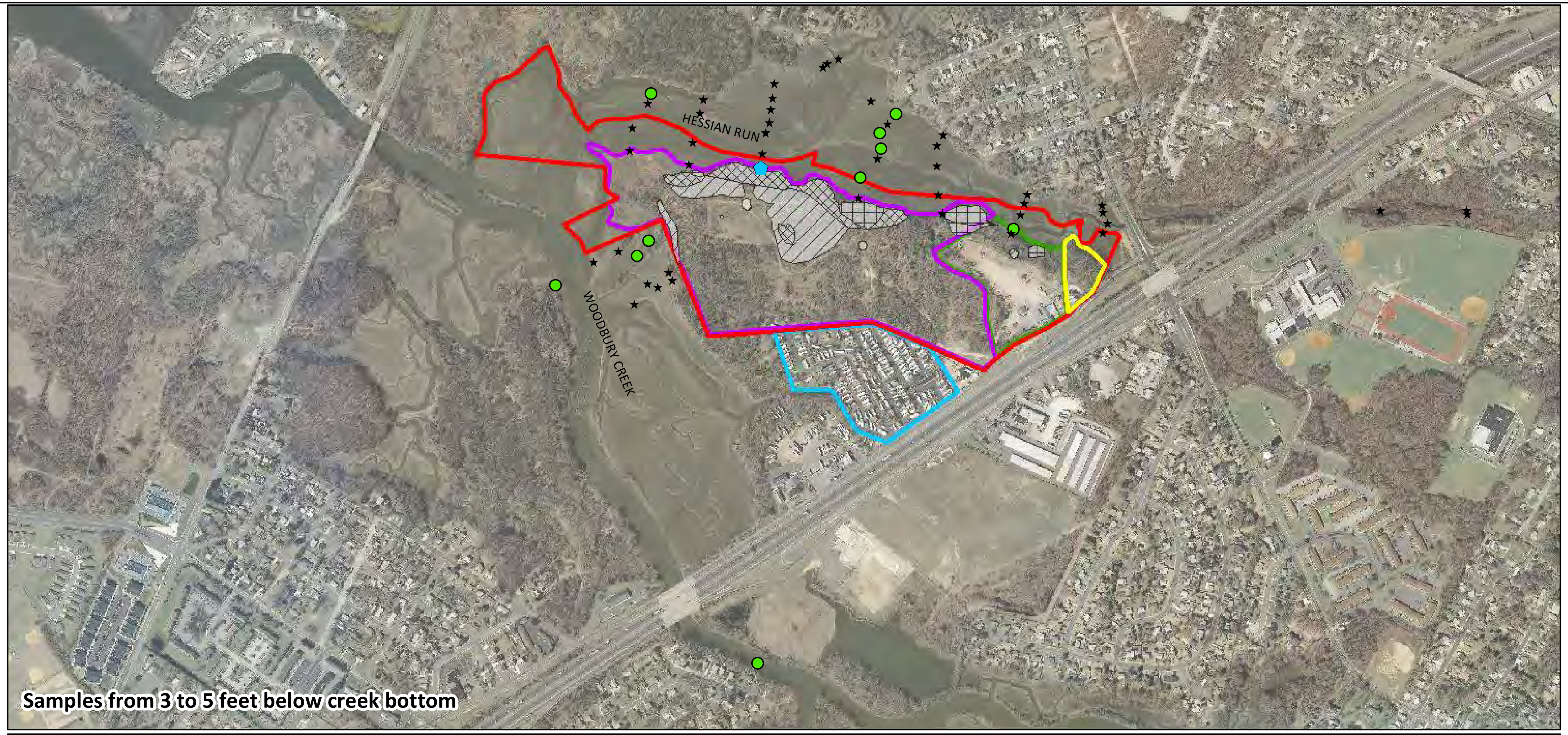

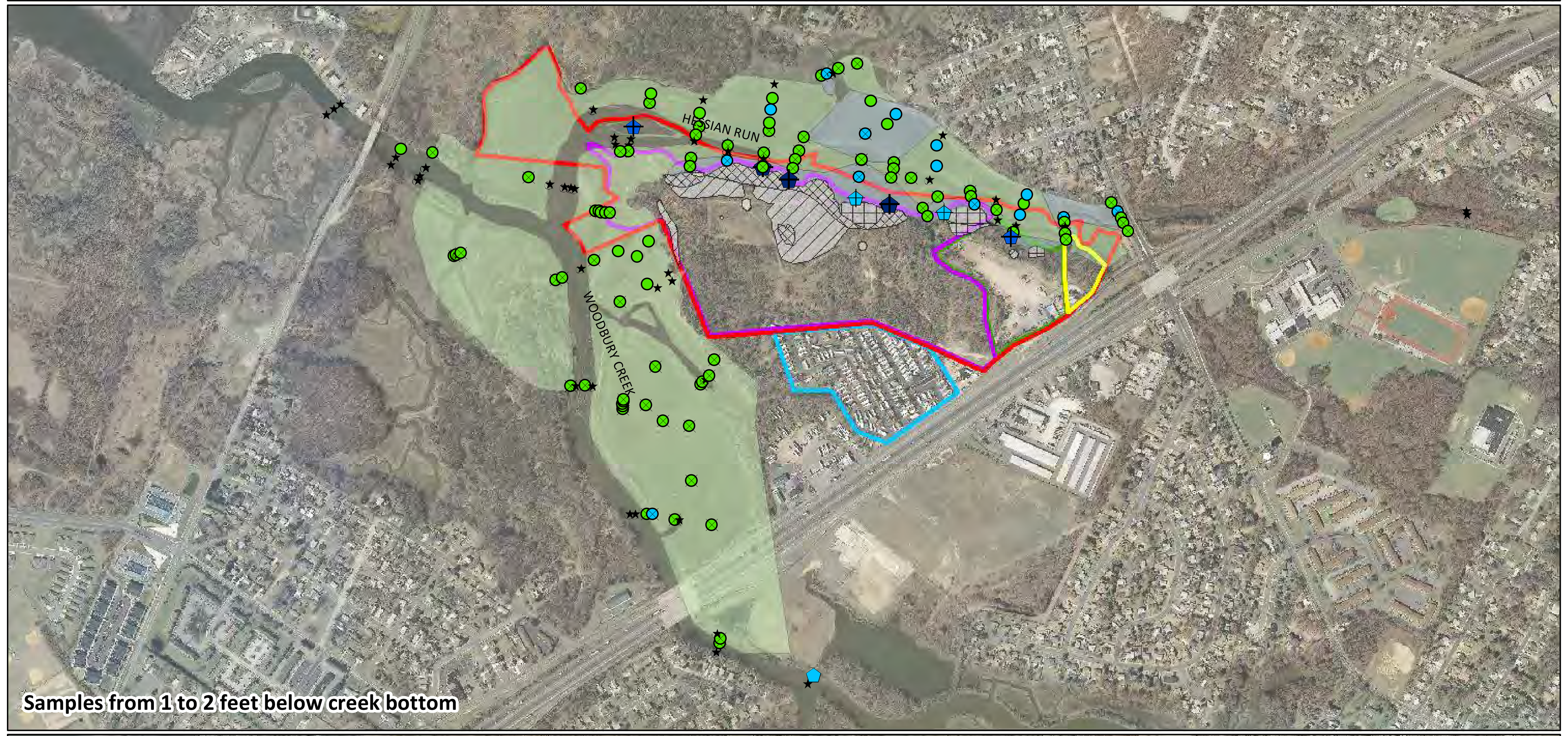

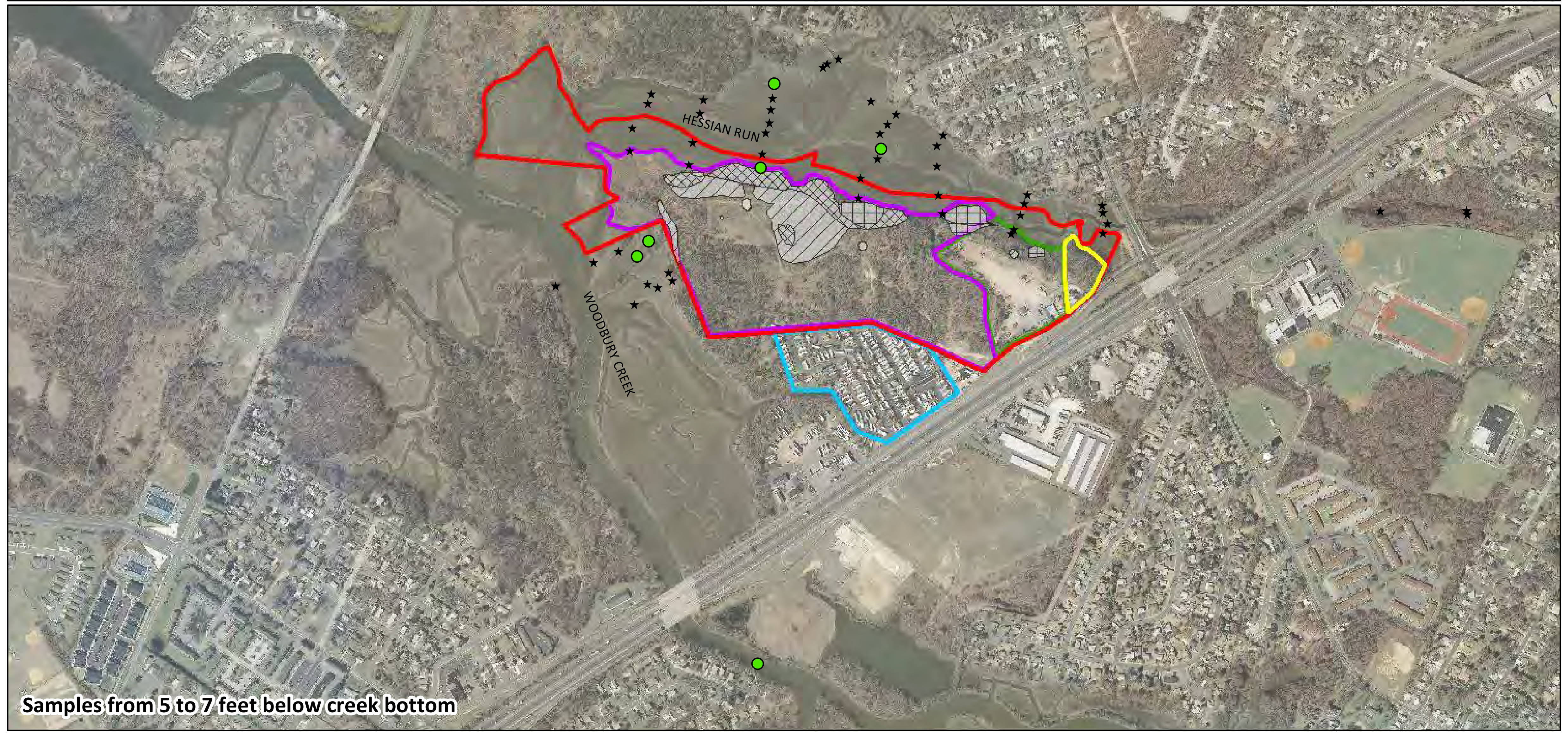

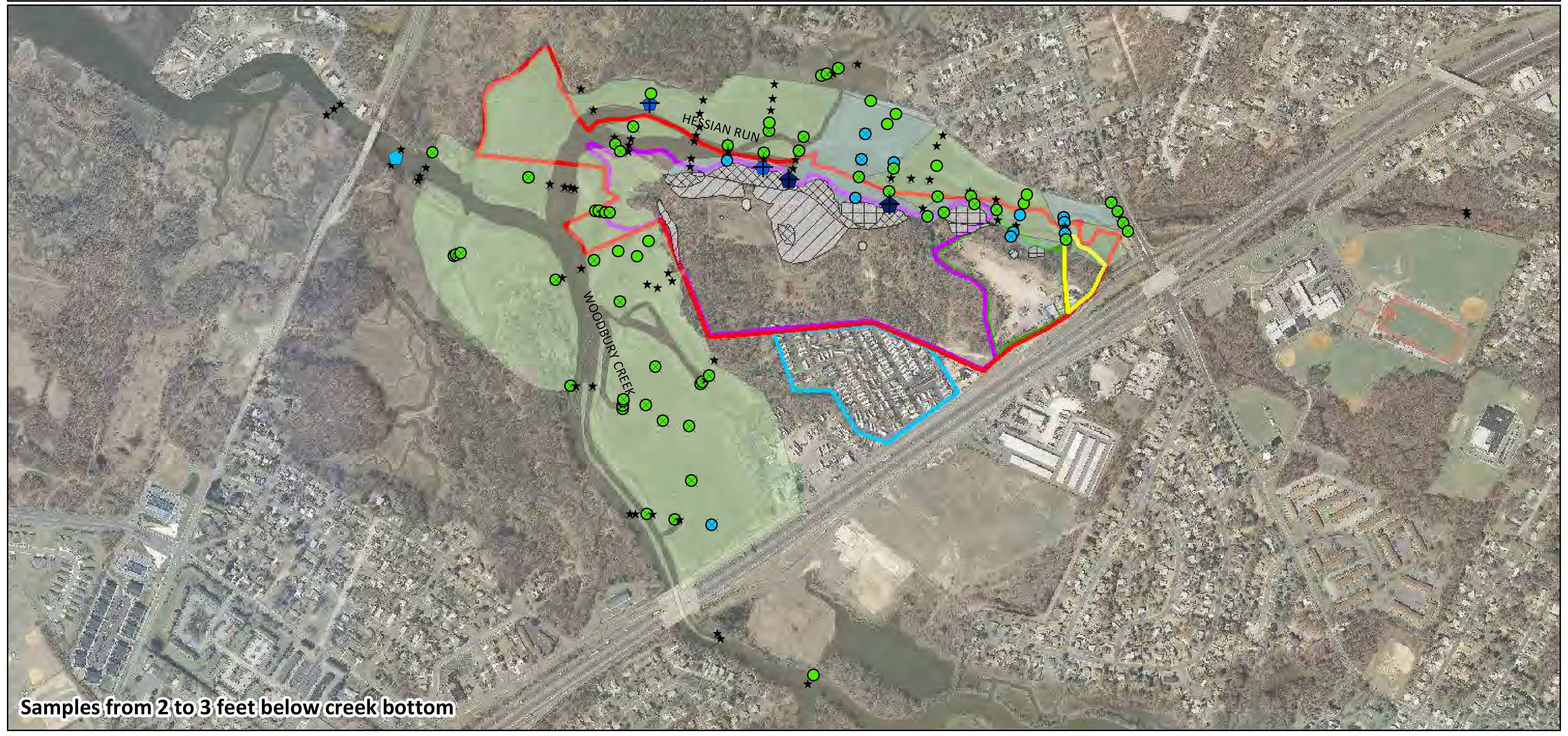

RI Lead Concentrations Result in mg/kg	NJDEP Lead Concentrations Result in mg/kg
< 31	<31
31 - 250	31 - 250
250 - 400	250 - 400
400 - 1,000	400 - 1,000
1,000 - 5,000	1,000 - 5,000
>5,000	>5,000

NJDEP Sample Results Lead Above 31 mg/kg
NJDEP Sample Results Lead Above 250 mg/kg

Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property

Delineated Waste Disposal Areas
Batteries and Waste
Batteries
Waste

Sediment Screening Criteria
NJDEP LEL (ECO)- 31 mg/kg
NJDEP SEL (ECO)- 250 mg/kg
EPARSL (Human Health) - 400 mg/kg

Notes
1. Sediment sampling results are presented for both RI (2012) and NJDEP RI (2005) Sampling.

Acronyms
EPA - Environmental Protection Agency
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP LEL - NJDEP Low effects limit
NJDEP SEL - NJDEP Severe effects limit

N

0 350 700 1,400 Feet
1 inch = 700 feet

Figure 4-7
Lead Concentrations in Sediment at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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Figure 4-8
Antimony Concentrations in Sediment at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

Sediment Screening Criteria
NJDEP LEL (ECO)- 16 mg/kg
NJDEP SEL (ECO)- 110 mg/kg
EPARSL (Human Health) - 3100 mg/kg

Notes
1. Sediment sampling results are presented for both RI (2012) and NJDEP RI (2005) Sampling.

Acronyms
EPA - Environmental Protection Agency
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP LEL - NJDEP Low effects limit
NJDEP SEL - NJDEP Severe effects limit

Figure 4-9
Copper Concentrations in Sediment at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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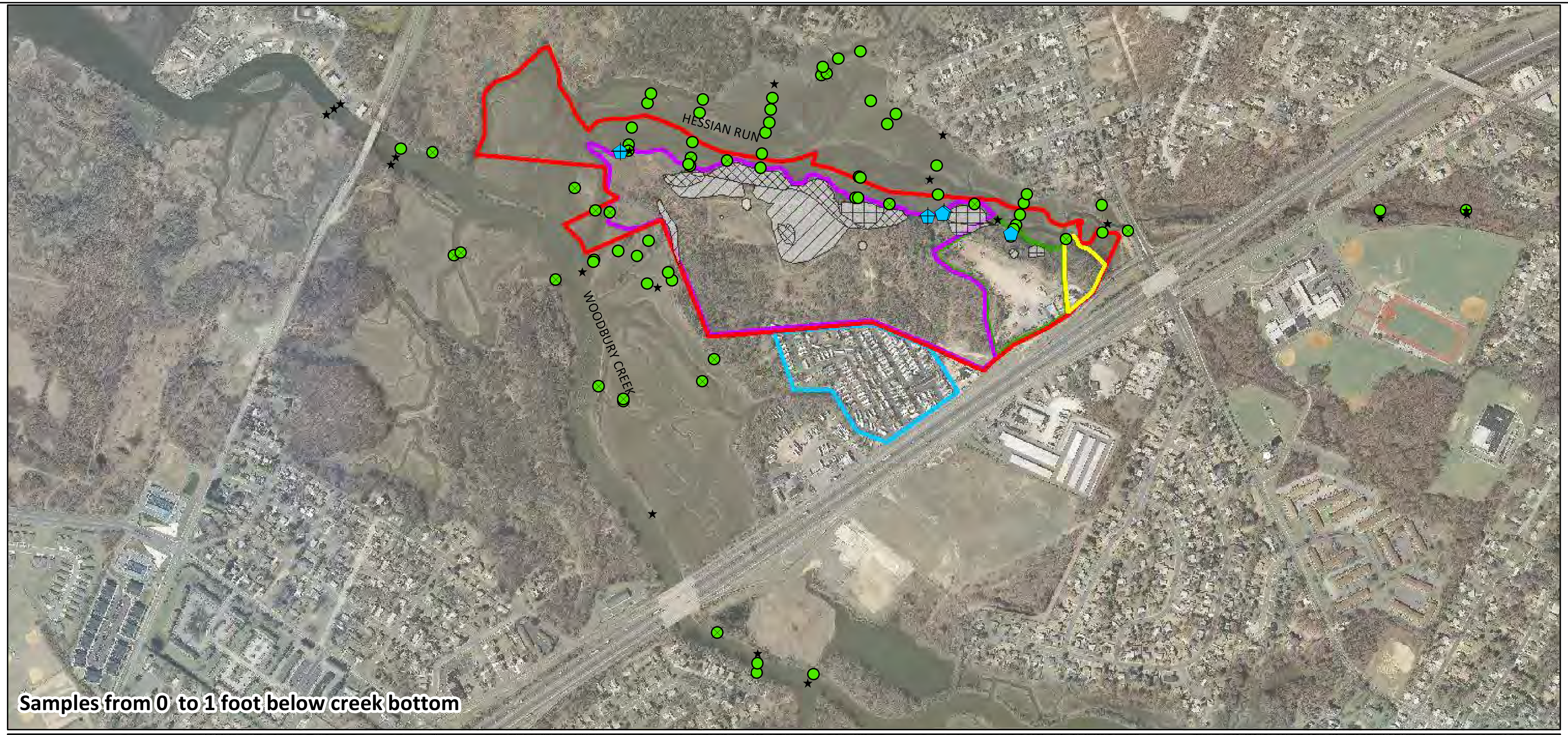

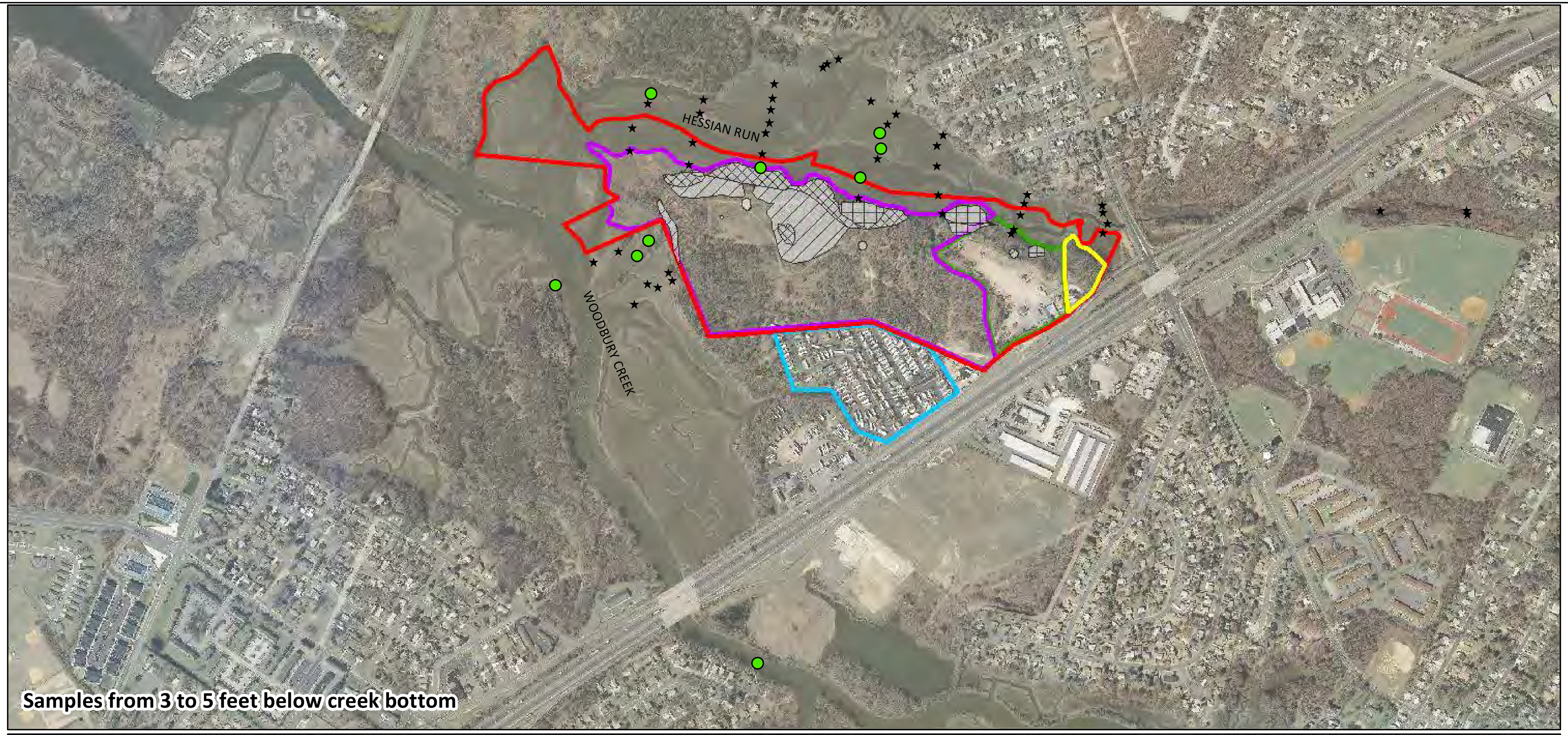

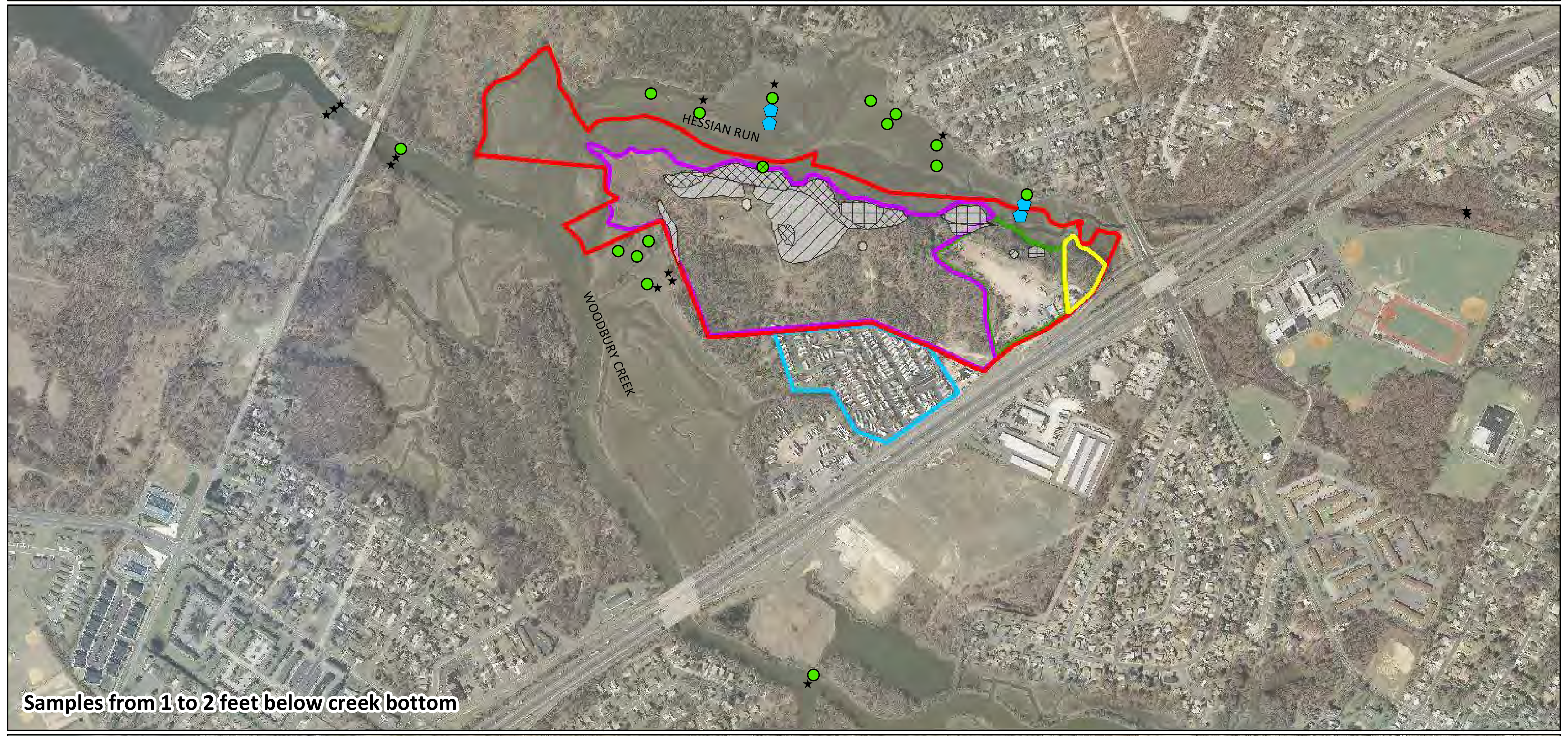

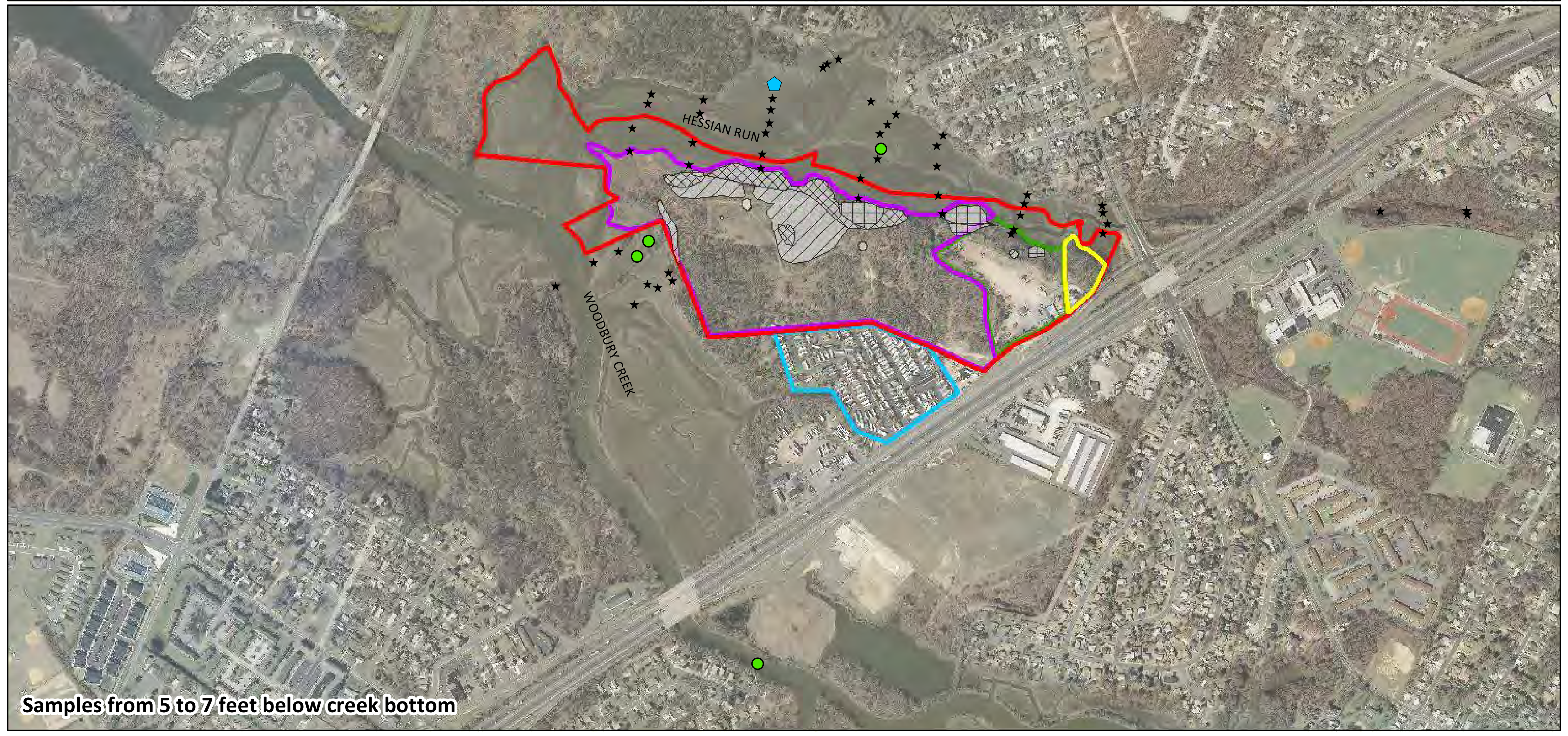

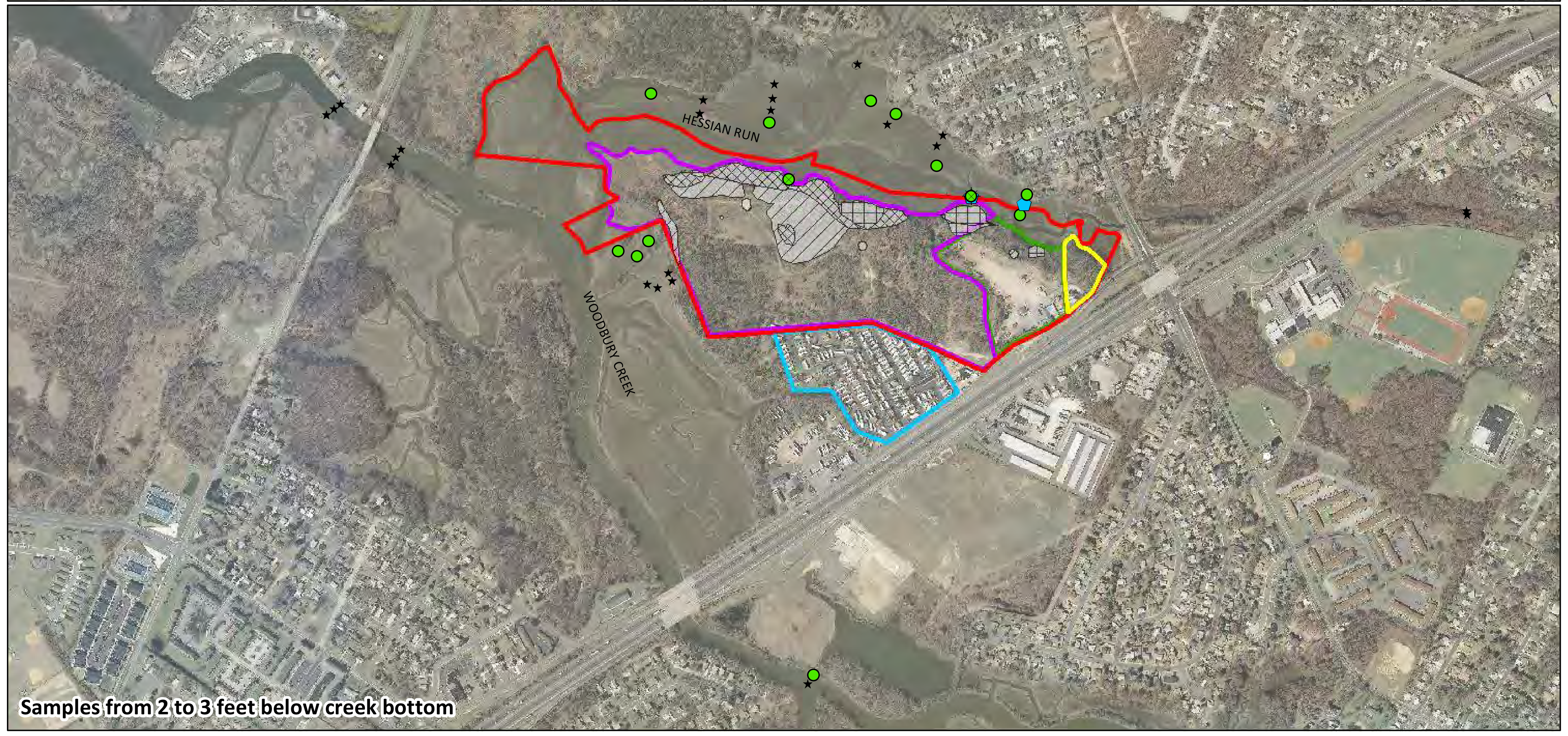

RI Zinc Concentrations Result in mg/kg	NJDEP Zinc Concentrations Result in mg/kg
<120	<120
120 - 820	120 - 820
820 - 23,000	820 - 23,000
>23,000	>23,000

Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property

Delineated Waste Disposal Areas

Batteries and Waste
Batteries
Waste

Sediment Screening Criteria

NJDEP LEL (ECO) - 120 mg/kg
NJDEP SEL (ECO) - 820 mg/kg
EPARSL (Human Health) - 23,000 mg/kg

Notes

1. Sediment sampling results are presented for both RI (2012) and NJDEP RI (2005) Sampling.

Acronyms

EPA - Environmental Protection Agency
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP LEL - NJDEP Low effects limit
NJDEP SEL - NJDEP Severe effects limit

N

0 350 700 1,400 Feet

1 inch = 700 feet

Figure 4-10
Zinc Concentrations in Sediment at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

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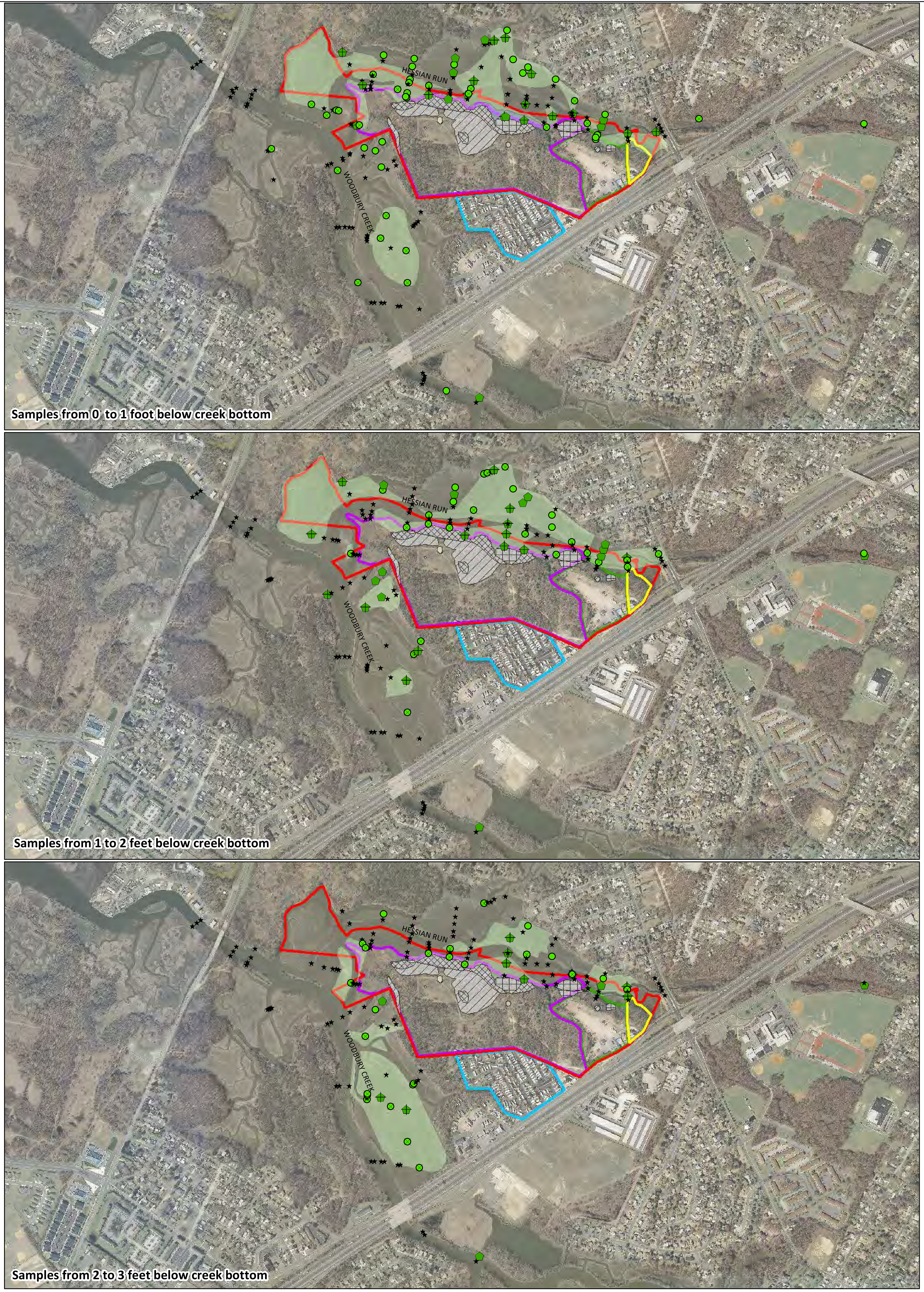

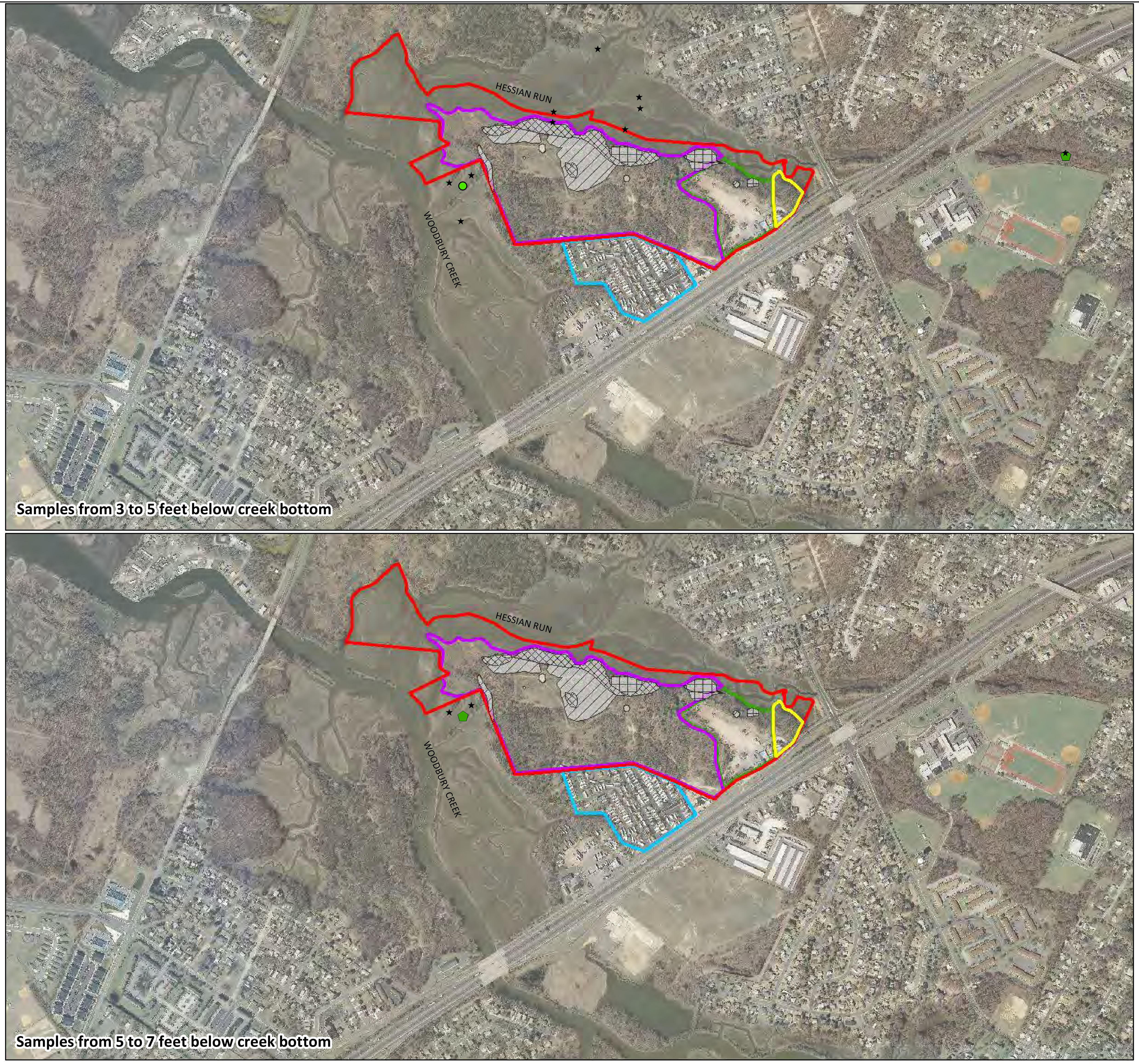

Aroclor 1254 Concentrations
Result in ug/kg
- <60
- 60 - 240
- 240 - 34,000
- >34,000

NJDEP Aroclor 1254 Concentrations
Result in ug/kg
- <60
- 60 - 240
- 240 - 34,000
- >34,000

NJDEP Sample Results Aroclor 1254 Above LEL (60 ug/kg)
NJDEP Sample Results Aroclor 1254 Above SEL (34,000 ug/kg)

Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property

Delineated Waste Disposal Areas
Batteries and Waste
Batteries
Waste

Sediment Screening Criteria
NJDEP LEL (ECO) - 60 ug/kg
EPARSL (Human Health) - 240 ug/kg
NJDEP SEL (ECO)- >34,000 ug/kg (sample speciffic)

Notes
1. Sediment sampling results are presented for both RI (2012) and NJDEP RI (2005) Sampling.

Acronyms
EPA - Environmental Protection Agency
EPA RSL - EPA remedial screening levels
NJDEP - New Jersey Department of Environmental Protection
NJDEP LEL - NJDEP Low effects limit
NJDEP SEL - NJDEP Severe effects limit

N

0 350 700 1,400 Feet
1 inch = 700 feet

Figure 4-12
Aroclor 1254 Concentrations in Sediment at Various Depths
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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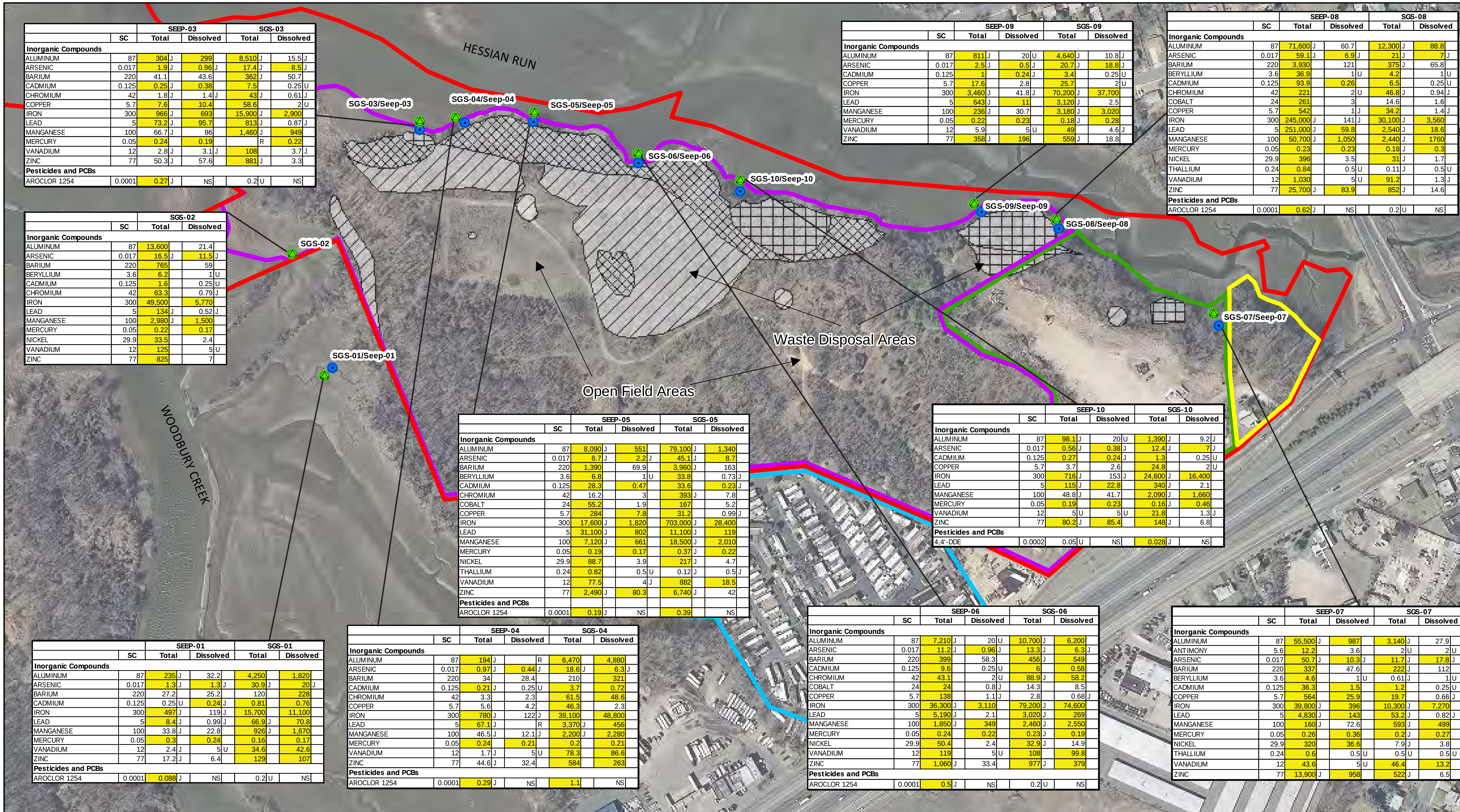

		SEEP-03		SGS-03	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	304 J	299	8,510 J	15.5 J
ARSENIC	0.017	1.9 J	0.96 J	17.4 J	8.5 J
BARIUM	220	41.1	43.6	362 J	50.7
CADMIUM	0.125	0.25 J	0.38	7.5	0.25 U
CHROMIUM	42	1.8 J	1.4 J	43 J	0.61 J
COPPER	5.7	7.6	10.4	58.6	2 U
IRON	300	966 J	693	15,900 J	2,900
LEAD	5	73.2 J	95.7	813 J	0.87 J
MANGANESE	100	66.7 J	86	1,460 J	949
MERCURY	0.05	0.24	0.19	R	0.22
VANADIUM	12	2.8 J	3.1 J	108	3.7 J
ZINC	77	50.3 J	57.6	881 J	3.3
Pesticides and PCBs					
AROCLOR 1254	0.0001	0.27 J	NS	0.2 U	NS

		SGS-02	
	SC	Total	Dissolved
Inorganic Compounds			
ALUMINUM	87	13,600	21.4
ARSENIC	0.017	16.5 J	11.5 J
BARIUM	220	765	59
BERYLLIUM	3.6	6.2	1 U
CADMIUM	0.125	1.6	0.25 U
CHROMIUM	42	63.3	0.79 J
IRON	300	49,500	5,770
LEAD	5	134 J	0.52 J
MANGANESE	100	2,980 J	1,500
MERCURY	0.05	0.22	0.17
NICKEL	29.9	33.5	2.4
VANADIUM	12	125	5 U
ZINC	77	825	7

		SEEP-09		SGS-09	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	811 J	20 U	4,640 J	10.8 J
ARSENIC	0.017	2.5 J	0.5 J	20.7 J	18.8 J
CADMIUM	0.125	1	0.24 J	3.4	0.25 U
COPPER	5.7	17.6	2.8	25.7	2 U
IRON	300	3,460 J	41.8 J	70,200 J	37,700
LEAD	5	643 J	11	3,120 J	2.5
MANGANESE	100	236 J	30.7	3,180 J	3,020
MERCURY	0.05	0.22	0.23	0.18 J	0.28
VANADIUM	12	5.9	5 U	49	4.6 J
ZINC	77	358 J	196	559 J	18.8

		SEEP-08		SGS-08	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	71,600 J	60.7	12,300 J	88.8
ARSENIC	0.017	59.1 J	6.9 J	21 J	7 J
BARIUM	220	3,930	121	375 J	65.8
BERYLLIUM	3.6	36.9	1 U	4.2	1 U
CADMIUM	0.125	93.9	0.26	6.5	0.25 U
CHROMIUM	42	221	2 U	46.8 J	0.94 J
COBALT	24	261	3	14.6	1.6
COPPER	5.7	542	1 J	34.2	1.4 J
IRON	300	245,000 J	141 J	30,100 J	3,560
LEAD	5	251,000 J	59.8	2,540 J	18.6
MANGANESE	100	50,700 J	1,050	2,440 J	1760
MERCURY	0.05	0.23	0.23	0.18 J	0.3
NICKEL	29.9	396	3.5	31 J	1.7
THALLIUM	0.24	0.84	0.5 U	0.11 J	0.5 U
VANADIUM	12	1,030	5 U	91.2	1.3 J
ZINC	77	25,700 J	83.9	852 J	14.6
Pesticides and PCBs					
AROCLOR 1254	0.0001	0.62 J	NS	0.2 U	NS

		SEEP-05		SGS-05	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	8,090 J	551	79,100 J	1,340
ARSENIC	0.017	6.7 J	2.2 J	45.1 J	8.7
BARIUM	220	1,390	69.9	3,960 J	163
BERYLLIUM	3.6	6.8	1 U	33.8	0.73 J
CADMIUM	0.125	28.3	0.47	33.6	0.23 J
CHROMIUM	42	16.2	3	393 J	7.8
COBALT	24	55.2	1.9	167	5.2
COPPER	5.7	284	7.8	31.2	0.99 J
IRON	300	17,600 J	1,820	703,000 J	28,400
LEAD	5	31,100 J	802	11,100 J	119
MANGANESE	100	7,120 J	661	18,500 J	2,010
MERCURY	0.05	0.19	0.17	0.37 J	0.22
NICKEL	29.9	88.7	3.9	217 J	4.7
THALLIUM	0.24	0.82	0.5 U	0.12 J	0.5 J
VANADIUM	12	77.5	4 J	882	18.5
ZINC	77	2,490 J	80.3	6,740 J	42
Pesticides and PCBs					
AROCLOR 1254	0.0001	0.19 J	NS	0.39	NS

		SEEP-10		SGS-10	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	98.1 J	20 U	1,390 J	9.2 J
ARSENIC	0.017	0.56 J	0.38 J	12.4 J	7 J
CADMIUM	0.125	0.27	0.24 J	1.3	0.25 U
COPPER	5.7	3.7	2.6	24.8	2 U
IRON	300	716 J	153 J	24,600 J	16,400
LEAD	5	115 J	22.8	340 J	2.1
MANGANESE	100	48.8 J	41.7	2,090 J	1,660
MERCURY	0.05	0.19	0.23	0.16 J	0.46
VANADIUM	12	5 U	5 U	21.8	1.3 J
ZINC	77	80.2 J	85.4	148 J	6.8
Pesticides and PCBs					
4,4'-DDE	0.0002	0.05 U	NS	0.028 J	NS

		SEEP-01		SGS-01	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	235 J	32.2	4,250	1,820
ARSENIC	0.017	1.3 J	1.3 J	30.9 J	20 J
BARIUM	220	27.2	25.2	120	228
CADMIUM	0.125	0.25 U	0.24 J	0.81	0.76
IRON	300	497 J	119 J	15,700	11,100
LEAD	5	8.4 J	0.99 J	66.9 J	70.8
MANGANESE	100	33.8 J	22.8	926 J	1,670
MERCURY	0.05	0.3	0.24	0.16	0.17
VANADIUM	12	2.4 J	5 U	34.6	42.6
ZINC	77	17.2 J	6.4	129	107
Pesticides and PCBs					
AROCLOR 1254	0.0001	0.088 J	NS	0.2 U	NS

		SEEP-04		SGS-04	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	194 J	R	6,470	4,880
ARSENIC	0.017	0.97 J	0.44 J	18.6 J	6.3 J
BARIUM	220	34	28.4	210	321
CADMIUM	0.125	0.21 J	0.25 U	3.7	0.72
CHROMIUM	42	3.3	2.3	61.5	48.6
COPPER	5.7	5.6	4.2	46.3	2.3
IRON	300	780 J	122 J	39,100	48,800
LEAD	5	67.1 J	R	3,370 J	456
MANGANESE	100	46.5 J	12.1 J	2,200 J	2,280
MERCURY	0.05	0.24	0.21	0.2	0.21
VANADIUM	12	1.7 J	5 U	78.3	86.6
ZINC	77	44.6 J	32.4	584	263
Pesticides and PCBs					
AROCLOR 1254	0.0001	0.29 J	NS	1.1	NS

		SEEP-06		SGS-06	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	7,210 J	20 U	10,700 J	6,200
ARSENIC	0.017	11.2 J	0.96 J	13.3 J	6.3 J
BARIUM	220	399	58.3	456 J	549
CADMIUM	0.125	9.6	0.25 U	6	0.58
CHROMIUM	42	43.1	2 U	88.9 J	58.2
COBALT	24	24	0.8 J	14.3	8.5
COPPER	5.7	138	1.1 J	2.8	0.68 J
IRON	300	36,300 J	3,110	79,200 J	74,600
LEAD	5	5,190 J	2.1	3,020 J	269
MANGANESE	100	1,850 J	349	2,460 J	2,550
MERCURY	0.05	0.24	0.22	0.23 J	0.19
NICKEL	29.9	50.4	2.4	32.9 J	14.9
VANADIUM	12	119	5 U	108	99.8
ZINC	77	1,060 J	33.4	977 J	379
Pesticides and PCBs					
AROCLOR 1254	0.0001	0.5 J	NS	0.2 U	NS

		SEEP-07		SGS-07	
	SC	Total	Dissolved	Total	Dissolved
Inorganic Compounds					
ALUMINUM	87	55,500 J	987	3,140 J	27.9
ANTIMONY	5.6	12.2	3.6	2 U	2 U
ARSENIC	0.017	50.7 J	10.3 J	11.7 J	17.8 J
BARIUM	220	337	47.6	222 J	112
BERYLLIUM	3.6	4.6	1 U	0.61 J	1 U
CADMIUM	0.125	36.3	1.5	1.2	0.25 U
COPPER	5.7	564	25.9	19.7	0.66 J
IRON	300	39,800 J	396	10,300 J	7,270
LEAD	5	4,830 J	143	53.2 J	0.82 J
MANGANESE	100	160 J	72.6	593 J	499
MERCURY	0.05	0.26	0.36	0.2 J	0.27
NICKEL	29.9	320	36.6	7.9 J	3.8
THALLIUM	0.24	0.6	0.5 U	0.5 U	0.5 U
VANADIUM	12	43.6	5 U	46.4	13.2
ZINC	77	13,900 J	958	522 J	6.5

Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property

RI Sediment Pore Water Sampling Location
RI Seep Sampling Location

Delineated Waste Disposal Areas

Batteries and Waste
Batteries
Waste

Notes

SC - RI Screening Criteria
Units - microgram/liter
NS - The compound or analyte was not analyzed
J - Estimated Concentration
U - Not detected above the listed minimum detection limit
Yellow highlighted results exceed the Matteo Site Screening Criteria
R- Rejected Data

Box Map Notes

Results for analytes that exceeded the screening criteria in either the total or dissolved samples were included in each box.

N

0 150 300 600 Feet

1 inch = 300 feet

Figure 4-13
Summary of Seep and Sediment Porewater Concentrations Above RI Screening Criteria
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

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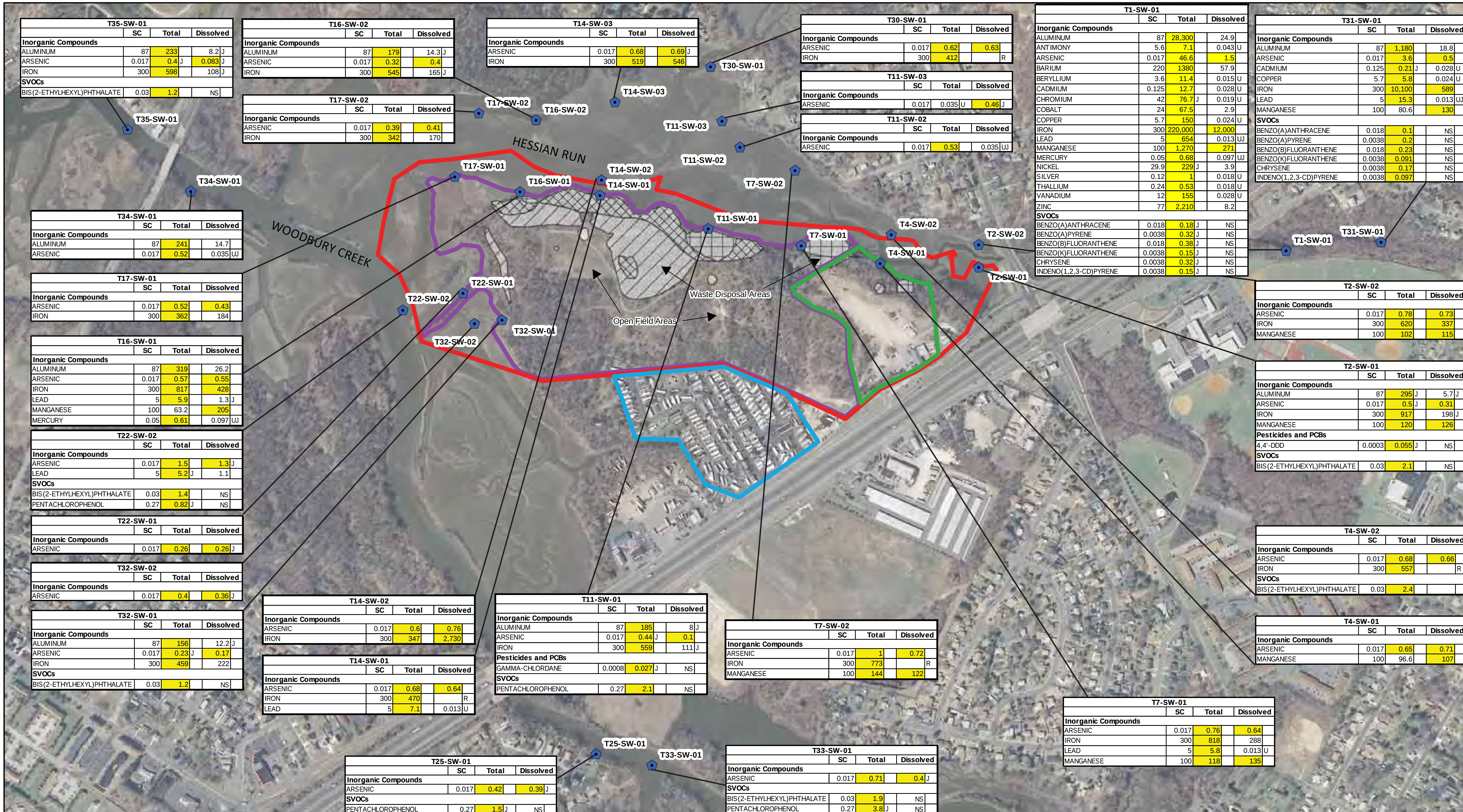


T35-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	233		8.2	J
ARSENIC	0.017	0.4	J	0.083	J
IRON	300	598		108	J
SVOCs					
BIS(2-ETHYLHEXYL)PHTHALATE	0.03	1.2		NS	

T16-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	179		14.3	J
ARSENIC	0.017	0.32		0.4	
IRON	300	545		165	J

T17-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.39		0.41	
IRON	300	342		170	

T14-SW-03

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.68		0.69	J
IRON	300	519		546	

T30-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.62		0.63	
IRON	300	412			R

T11-SW-03

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.035	U	0.46	J

T11-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.53		0.035	UJ

T1-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	28,300		24.9	
ANTIMONY	5.6	7.1		0.043	U
ARSENIC	0.017	46.6		1.5	
BARIUM	220	1380		57.9	
BERYLLIUM	3.6	11.4		0.015	U
CADMIUM	0.125	12.7		0.028	U
CHROMIUM	42	76.7	J	0.019	U
COBALT	24	67.5		2.9	
COPPER	5.7	150		0.024	U
IRON	300	220,000		12,000	
LEAD	5	654		0.013	UJ
MANGANESE	100	1,270		271	
MERCURY	0.05	0.68		0.097	UJ
NICKEL	29.9	229	J	3.9	
SILVER	0.12	1		0.018	U
THALLIUM	0.24	0.53		0.018	U
VANADIUM	12	155		0.028	U
ZINC	77	2,210		8.2	
SVOCs					
BENZO(A)ANTHRACENE	0.018	0.18	J	NS	
BENZO(A)PYRENE	0.0038	0.32	J	NS	
BENZO(B)FLUORANTHENE	0.018	0.38	J	NS	
BENZO(K)FLUORANTHENE	0.0038	0.15	J	NS	
CHRYSENE	0.0038	0.32	J	NS	
INDENO(1,2,3-CD)PYRENE	0.0038	0.15	J	NS	

T31-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	1,180		18.8	
ARSENIC	0.017	3.6		0.5	
CADMIUM	0.125	0.21	J	0.028	U
COPPER	5.7	5.8		0.024	U
IRON	300	10,100		589	
LEAD	5	15.3		0.013	UJ
MANGANESE	100	80.6		130	
SVOCs					
BENZO(A)ANTHRACENE	0.018	0.1		NS	
BENZO(A)PYRENE	0.0038	0.2		NS	
BENZO(B)FLUORANTHENE	0.018	0.23		NS	
BENZO(K)FLUORANTHENE	0.0038	0.091		NS	
CHRYSENE	0.0038	0.17		NS	
INDENO(1,2,3-CD)PYRENE	0.0038	0.097		NS	

T34-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	241		14.7	
ARSENIC	0.017	0.52		0.035	UJ

T17-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.52		0.43	
IRON	300	362		184	

T16-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	319		26.2	
ARSENIC	0.017	0.57		0.55	
IRON	300	817		428	
LEAD	5	5.9		1.3	J
MANGANESE	100	63.2		205	
MERCURY	0.05	0.61		0.097	UJ

T22-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	1.5		1.3	J
LEAD	5	5.2	J	1.1	
SVOCs					
BIS(2-ETHYLHEXYL)PHTHALATE	0.03	1.4		NS	
PENTACHLOROPHENOL	0.27	0.82	J	NS	

T22-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.26		0.26	J

T32-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.4		0.36	J

T32-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	156		12.2	J
ARSENIC	0.017	0.23	J	0.17	
IRON	300	459		222	
SVOCs					
BIS(2-ETHYLHEXYL)PHTHALATE	0.03	1.2		NS	

T2-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.78		0.73	
IRON	300	620		337	
MANGANESE	100	102		115	

T2-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	295	J	5.7	J
ARSENIC	0.017	0.5	J	0.31	
IRON	300	917		198	J
MANGANESE	100	120		126	
Pesticides and PCBs					
4,4'-DDD	0.0003	0.055	J	NS	
SVOCs					
BIS(2-ETHYLHEXYL)PHTHALATE	0.03	2.1		NS	

T4-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.68		0.66	
IRON	300	557			R
SVOCs					
BIS(2-ETHYLHEXYL)PHTHALATE	0.03	2.4			

T4-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.65		0.71	
MANGANESE	100	96.6		107	

T14-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.6		0.76	
IRON	300	347		2,730	

T14-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.68		0.64	
IRON	300	470			R
LEAD	5	7.1		0.013	U

T11-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	87	185		8	J
ARSENIC	0.017	0.44	J	0.1	
IRON	300	559		111	J
Pesticides and PCBs					
GAMMA-CHLORDANE	0.0008	0.027	J	NS	
SVOCs					
PENTACHLOROPHENOL	0.27	2.1		NS	

T7-SW-02

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	1		0.72	
IRON	300	773			R
MANGANESE	100	144		122	

T7-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.76		0.64	
IRON	300	818		288	
LEAD	5	5.8		0.013	U
MANGANESE	100	118		135	

T25-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.42		0.39	J
SVOCs					
PENTACHLOROPHENOL	0.27	1.5	J	NS	

T33-SW-01

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	0.017	0.71		0.4	J
SVOCs					
BIS(2-ETHYLHEXYL)PHTHALATE	0.03	1.9		NS	
PENTACHLOROPHENOL	0.27	3.8	J	NS	

Site Areas

- Matteo Property
- Scrapyard Area
- Open Field/Waste Disposal Area
- Willow Woods Property

RI Surface Water Sample

Delineated Waste Disposal Areas

- Batteries and Waste
- Batteries
- Waste

Acronyms

SC - Screening Criteria
Units - microgram/liter
NS - The compound or analyte was not analyzed
J - Estimated Concentration
U - Not detected above the listed minimum detection limit
Yellow highlighted results exceed the Matteo Site Screening Criteria
R- Rejected Data

Box Map Notes

Results for analytes that exceeded the screening criteria in either the total or dissolved samples were included in each box.

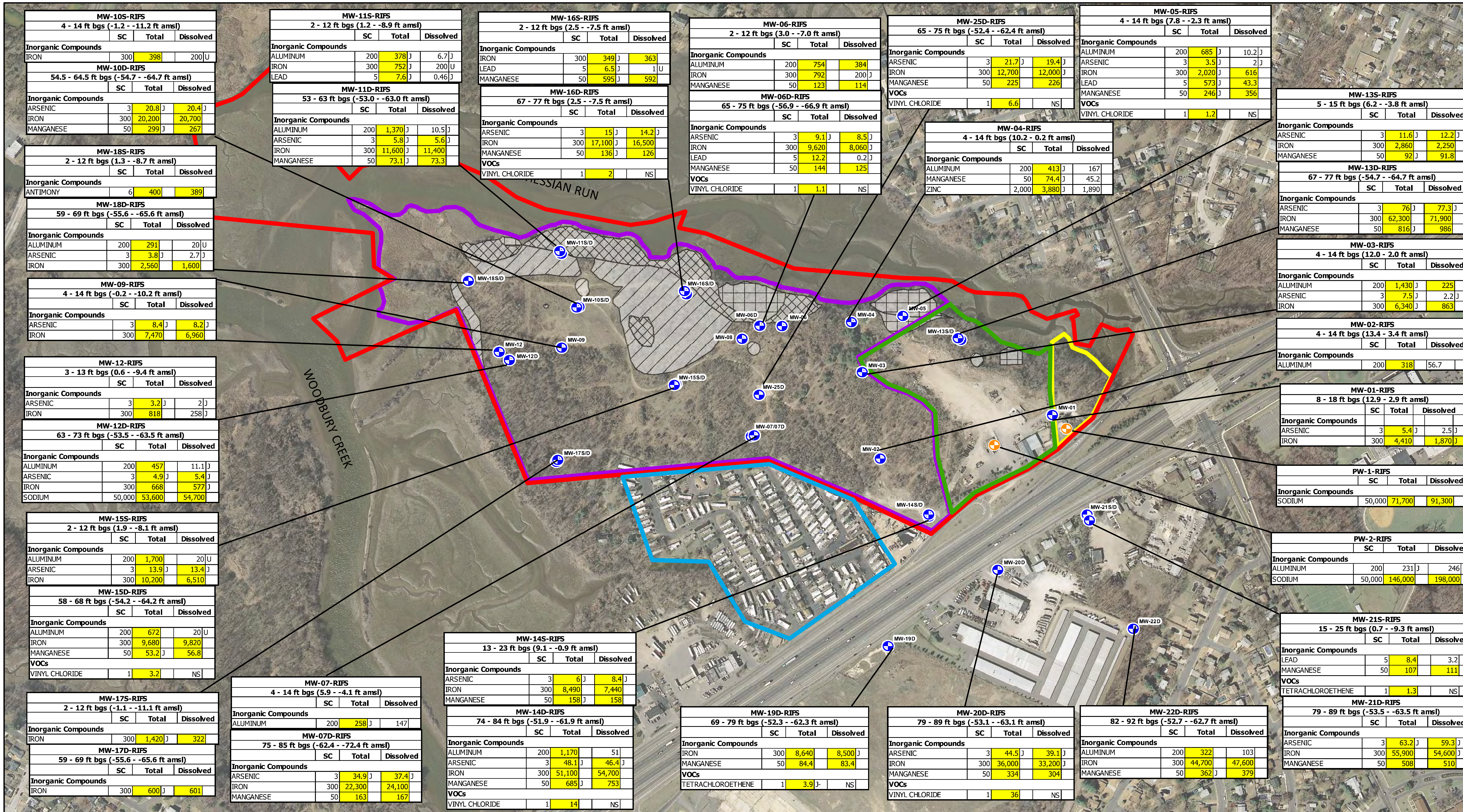
N

0 300 600 1,200 Feet

1 inch = 600 feet

Figure 4-14
Summary of Surface Water Concentrations Above RI Screening Criteria
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith



MW-10S-RIFS
4 - 14 ft bgs (-1.2 - -11.2 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
IRON	300	398		200	U

MW-10D-RIFS
54.5 - 64.5 ft bgs (-54.7 - -64.7 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	20.8	J	20.4	J
IRON	300	20,200		20,700	
MANGANESE	50	299	J	267	

MW-18S-RIFS
2 - 12 ft bgs (1.3 - -8.7 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ANTIMONY	6	400		389	

MW-18D-RIFS
59 - 69 ft bgs (-55.6 - -65.6 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	291		20	U
ARSENIC	3	3.8	J	2.7	J
IRON	300	2,560		1,600	

MW-09-RIFS
4 - 14 ft bgs (-0.2 - -10.2 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	8.4	J	8.2	J
IRON	300	7,470		6,960	

MW-12-RIFS
3 - 13 ft bgs (0.6 - -9.4 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	3.2	J	2	J
IRON	300	818		258	J

MW-12D-RIFS
63 - 73 ft bgs (-53.5 - -63.5 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	457		11.1	J
ARSENIC	3	4.9	J	5.4	J
IRON	300	668		577	J
SODIUM	50,000	53,600		54,700	

MW-15S-RIFS
2 - 12 ft bgs (1.9 - -8.1 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	1,700		20	U
ARSENIC	3	13.9	J	13.4	J
IRON	300	10,200		6,510	

MW-15D-RIFS
58 - 68 ft bgs (-54.2 - -64.2 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	672		20	U
IRON	300	9,680		9,820	
MANGANESE	50	53.2	J	56.8	
VOCs					
VINYL CHLORIDE	1	3.2		NS	

MW-17S-RIFS
2 - 12 ft bgs (-1.1 - -11.1 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
IRON	300	1,420	J	322	

MW-17D-RIFS
59 - 69 ft bgs (-55.6 - -65.6 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
IRON	300	600	J	601	

MW-11S-RIFS
2 - 12 ft bgs (1.2 - -8.9 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	378	J	6.7	J
IRON	300	752	J	200	U
LEAD	5	7.6	J	0.46	J

MW-11D-RIFS
53 - 63 ft bgs (-53.0 - -63.0 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	1,370	J	10.5	J
ARSENIC	3	5.8	J	5.6	J
IRON	300	11,600	J	11,400	
MANGANESE	50	73.1	J	73.3	

MW-16S-RIFS
2 - 12 ft bgs (2.5 - -7.5 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
IRON	300	349	J	363	
LEAD	5	6.5	J	1	U
MANGANESE	50	595	J	592	

MW-16D-RIFS
67 - 77 ft bgs (2.5 - -7.5 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	15	J	14.2	J
IRON	300	17,100	J	16,500	
MANGANESE	50	136	J	126	
VOCs					
VINYL CHLORIDE	1	2		NS	

MW-06-RIFS
2 - 12 ft bgs (3.0 - -7.0 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	754		384	
IRON	300	792		200	J
MANGANESE	50	123		114	

MW-06D-RIFS
65 - 75 ft bgs (-56.9 - -66.9 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	9.1	J	8.5	J
IRON	300	9,620		8,060	J
LEAD	5	12.2		0.2	J
MANGANESE	50	144		125	
VOCs					
VINYL CHLORIDE	1	1.1		NS	

MW-25D-RIFS
65 - 75 ft bgs (-52.4 - -62.4 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	21.7	J	19.4	J
IRON	300	12,700		12,000	J
MANGANESE	50	225		226	
VOCs					
VINYL CHLORIDE	1	6.6		NS	

MW-04-RIFS
4 - 14 ft bgs (10.2 - 0.2 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	413	J	167	
MANGANESE	50	74.4	J	45.2	
ZINC	2,000	3,880	J	1,890	

MW-05-RIFS
4 - 14 ft bgs (7.8 - -2.3 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	685	J	10.2	J
ARSENIC	3	3.5	J	2	J
IRON	300	2,020	J	616	
LEAD	5	573	J	43.3	
MANGANESE	50	246	J	356	
VOCs					
VINYL CHLORIDE	1	1.2		NS	

MW-13S-RIFS
5 - 15 ft bgs (6.2 - -3.8 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	11.6	J	12.2	J
IRON	300	2,860		2,250	
MANGANESE	50	92	J	91.8	

MW-13D-RIFS
67 - 77 ft bgs (-54.7 - -64.7 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	76	J	77.3	J
IRON	300	62,300		71,900	
MANGANESE	50	816	J	986	

MW-03-RIFS
4 - 14 ft bgs (12.0 - 2.0 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	1,430	J	225	
ARSENIC	3	7.5	J	2.2	J
IRON	300	6,340	J	863	

MW-02-RIFS
4 - 14 ft bgs (13.4 - 3.4 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	318		56.7	

MW-01-RIFS
8 - 18 ft bgs (12.9 - 2.9 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	5.4	J	2.5	J
IRON	300	4,410		1,870	J

PW-1-RIFS

	SC	Total		Dissolved	
Inorganic Compounds					
SODIUM	50,000	71,700		91,300	

PW-2-RIFS

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	231	J	246	
SODIUM	50,000	146,000		198,000	

MW-21S-RIFS
15 - 25 ft bgs (0.7 - -9.3 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
LEAD	5	8.4		3.2	
MANGANESE	50	107		111	
VOCs					
TETRACHLOROETHENE	1	1.3		NS	

MW-21D-RIFS
79 - 89 ft bgs (-53.5 - -63.5 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	63.2	J	59.3	J
IRON	300	55,900		54,600	J
MANGANESE	50	508		510	

MW-07-RIFS
4 - 14 ft bgs (5.9 - -4.1 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	258	J	147	

MW-07D-RIFS
75 - 85 ft bgs (-62.4 - -72.4 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	34.9	J	37.4	J
IRON	300	22,300		24,100	
MANGANESE	50	163		167	

MW-14S-RIFS
13 - 23 ft bgs (9.1 - -0.9 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	6	J	8.4	J
IRON	300	8,490		7,440	
MANGANESE	50	158	J	158	

MW-14D-RIFS
74 - 84 ft bgs (-51.9 - -61.9 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	1,170		51	
ARSENIC	3	48.1	J	46.4	J
IRON	300	51,100		54,700	
MANGANESE	50	685	J	753	
VOCs					
VINYL CHLORIDE	1	14		NS	

MW-19D-RIFS
69 - 79 ft bgs (-52.3 - -62.3 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
IRON	300	8,640		8,500	J
MANGANESE	50	84.4		83.4	
VOCs					
TETRACHLOROETHENE	1	3.9	J-	NS	

MW-20D-RIFS
79 - 89 ft bgs (-53.1 - -63.1 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ARSENIC	3	44.5	J	39.1	J
IRON	300	36,000		33,200	J
MANGANESE	50	334		304	
VOCs					
VINYL CHLORIDE	1	36		NS	

MW-22D-RIFS
82 - 92 ft bgs (-52.7 - -62.7 ft amsl)

	SC	Total		Dissolved	
Inorganic Compounds					
ALUMINUM	200	322		103	
IRON	300	44,700		47,600	
MANGANESE	50	362	J	379	

Matteo Property
Scrapyard Area
Open Field/Waste Disposal Area
Rental Home Area
Willow Woods Property

Monitoring Well
Potable Well (locations are approximate)

Delineated Waste Disposal Areas

Batteries and Waste
Batteries
Waste

Box Map Notes

SC - Screening Criteria
Units - microgram/liter
NS - The compound or analyte was not analyzed
J - Estimated Concentration
U - Not detected above the listed minimum detection limit
Yellow highlighted results exceed the Matteo Site Screening Criteria
ft bgs - feet below ground surface
ft amsl - feet above mean sea level

N

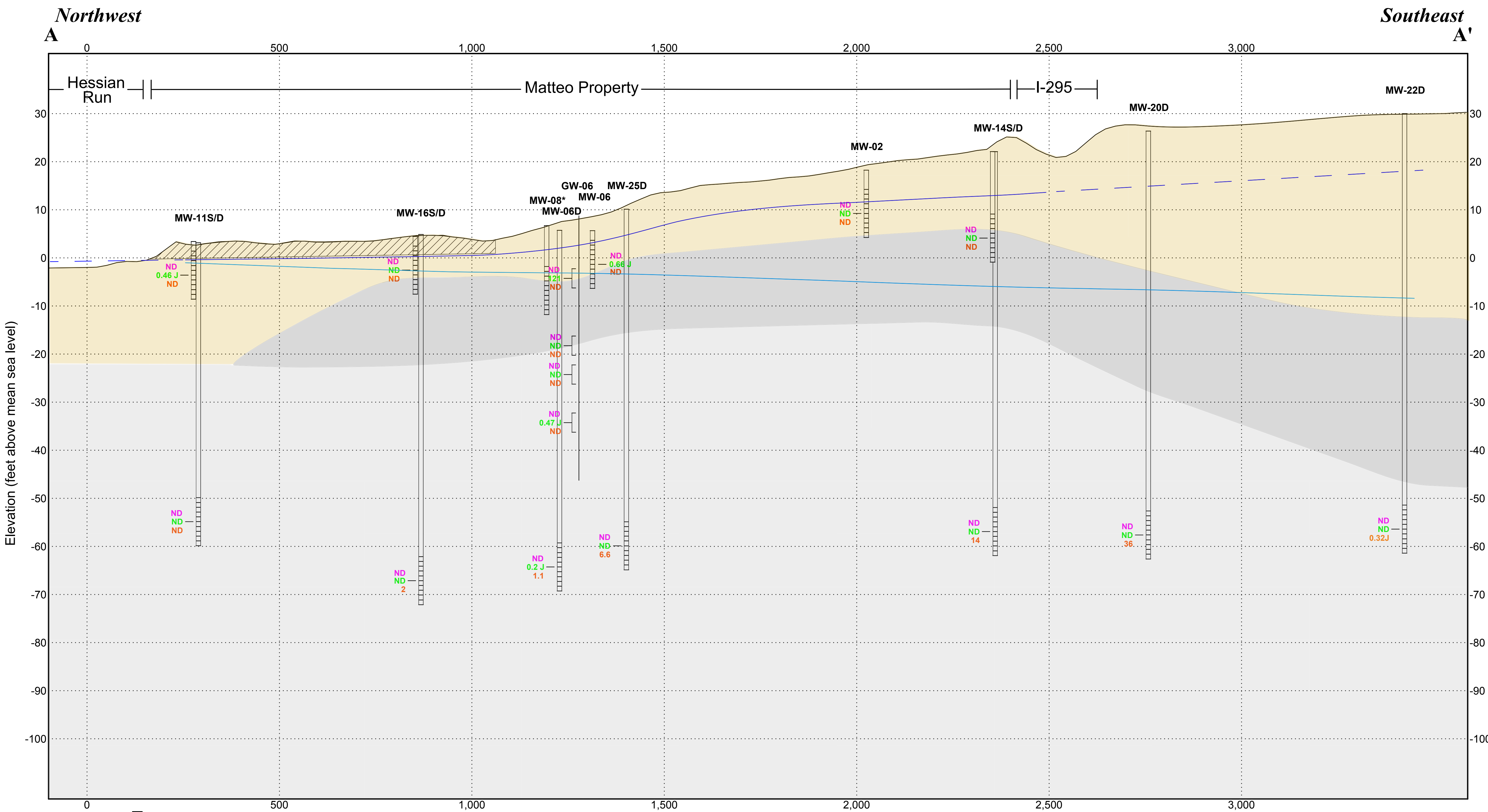
0 225 450 900 Feet

1 inch = 450 feet

Figure 4-15
Summary of Groundwater Concentrations Above RI Screening Criteria
Matteo & Sons, Inc. Site
Thorofare, NJ

CDM Smith

TOMASELLIT \
\\svr1\IMS\GIS\Matteo\MXD\Draft RI Report\Figure_4-14_GW_MW_Box_Map.mxd 4/1/2015



LEGEND: Well Screen Well Casing Groundwater Screening Point and Sample interval

Horizontal Scale (feet) 0 250

Vertical Exaggeration: 12.5x

Vertical Scale (feet) 0 20

Ground Surface

Water table as measured in shallow wells at high tide on 2/1/12. Dashed where inferred.

Potentiometric surface measured in deep wells at high tide on 2/1/12.

Delineated Waste Disposal Area (based on NJDEP data)

Lithologic Units

Cape May Formation

Merchantville Formation

Magothy Formation

*MW-08 was abandoned on 10/25/2011

Groundwater Sample Results

Tetrachloroethene (PCE)

Lead

Vinyl Chloride

All Results in micrograms per liter (ug/L)

ND - non detect

J - estimated concentration

CDM Smith

Figure 4-16
Select Groundwater Sampling Results
Cross Section A-A'
Matteo & Sons, Inc. Site
Thorofare, NJ

STANDARD CROSS SECTION: MATTEO STRETCH MATTEO.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 7/9/12 REV.

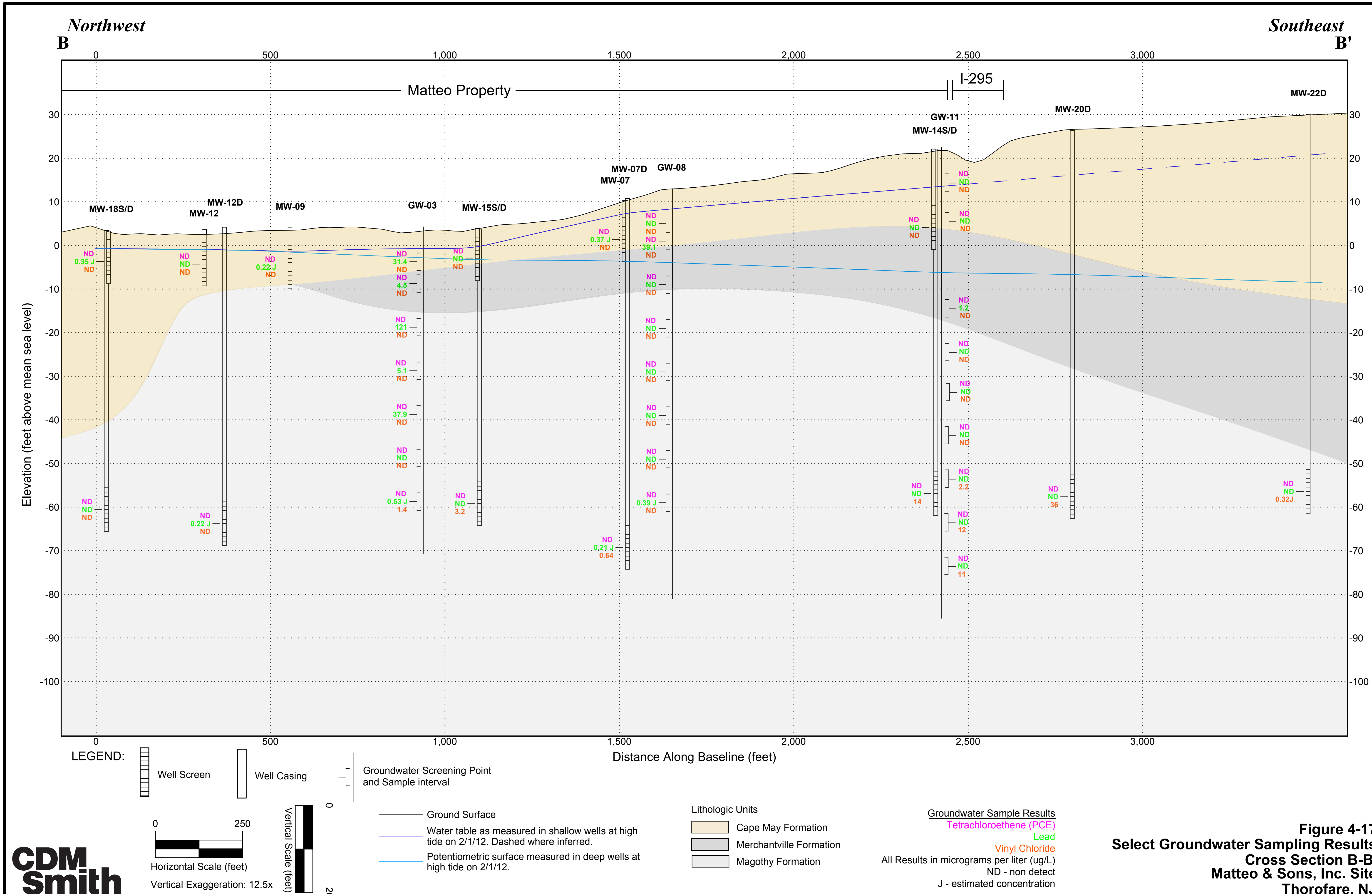


Figure 4-17
Select Groundwater Sampling Results
Cross Section B-B'
Matteo & Sons, Inc. Site
Thorofare, NJ

STANDARD CROSS SECTION: MATTEO STRETCH MATTEO.GPJ STANDARD_ENVIRONMENTAL_PROJECT.GDT 6/22/12 REV.

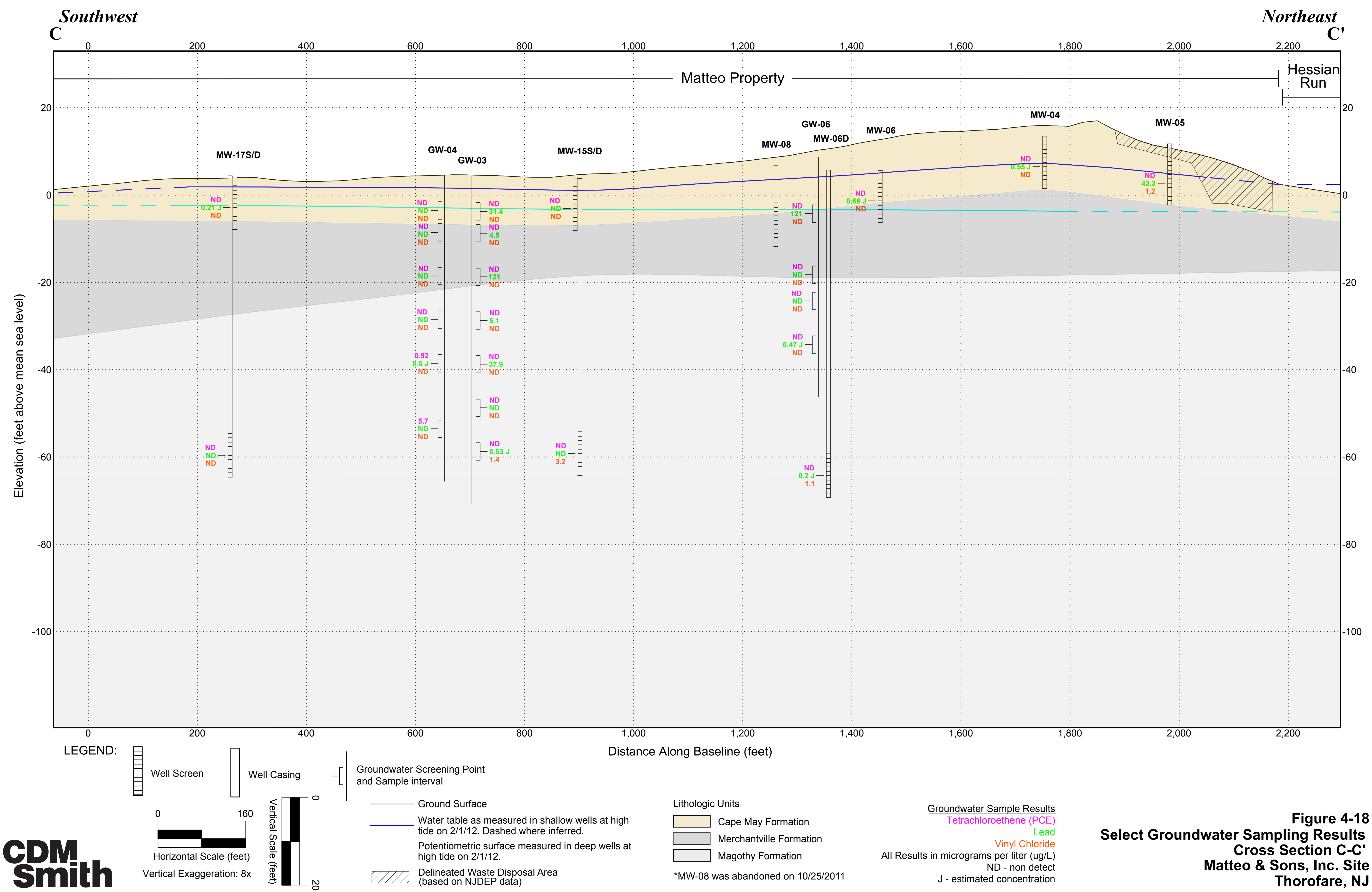


Figure 4-18
Select Groundwater Sampling Results
Cross Section C-C'
Matteo & Sons, Inc. Site
Thorofare, NJ

Appendix B

Appendix B

Volume Calculations for Source Materials and Contaminated Soils

Appendix B
Volume Calculations - Soil (Overlapping Areas)
Matteo & Sons, Inc. Site
Thorofare, NJ

Depth	Polygon		Area from "Belt" Shapefiles (square feet)	Calculated Average Depth (feet)	Volume (cubic feet)	Volume (cubic yards)
Scrapyard Area (combined lead and PCBs)						
Commercial						
0-2	1	SY ALL	181,657.0	2	363,314.0	13,456.1
	2			2	0.0	0.0
	3			2	0.0	0.0
			181,657.0		**Total**	**13,456.1**
2-4	1	SY North	13,533.0	2	27,066.0	1,002.4
	2	SY South	3,681.0	2	7,362.0	272.7
	3			2	0.0	0.0
			17,214.0		**Total**	**1,275.1**
Open Field/Waste Disposal						
Commercial (combined lead and PCBs)						
0-2	1	OF Main	168,894.0	2	337,788.0	12,510.7
	2	Smelt North	16,515.0	2	33,030.0	1,223.3
	3	Smelt South	14,200.0	2	28,400.0	1,051.9
	2	OF South	4,207.0	2	8,414.0	311.6
	3	OF East	4,793.0	2	9,586.0	355.0
	4	OF West	26,087.0	2	52,174.0	1,932.4
	5	Berm Pit	5,652.0	2	11,304.0	418.7
			240,348.0		**Total**	**17,803.6**
2-4	1	Smelt	4,828.0	2	9,656.0	357.6
	2	OF South 1	4,054.0	2	8,108.0	300.3
	3	OF South 2	8,112.0	2	16,224.0	600.9
	4	OF North	8,819.0	2	17,638.0	653.3
	5	OF East	3,770.0	2	7,540.0	279.3
	6	OF West	17,807.0	2	35,614.0	1,319.0
	7	Berm Pit	5,652.0	2	11,304.0	418.7
			53,042.0		**Total**	**3,929.0**
4-8	1	Smelt	3,403.0	4	13,612.0	504.1
	2	Berm Pit	5,652.0	4	22,608.0	837.3
			9,055.0		**Total**	**1,341.5**
Eco (only)						
0-1	1	OF South 3	46,853.0	1	46,853.0	1,735.3
	2	OF North	102,746.0	1	102,746.0	3,805.4
	3	Smelt	7,373.0	1	7,373.0	273.1
	4			2	0.0	0.0
			156,972.0		**Total**	**5,813.8**

Appendix B
Volume Calculations - Soil (Overlapping Areas)
Matteo & Sons, Inc. Site
Thorofare, NJ

Depth	Polygon		Area from "Belt" Shapefiles (square feet)	Calculated Average Depth (feet)	Volume (cubic feet)	Volume (cubic yards)
Rental Home Area						
0-2	1	RH	18,005.0	2	36,010.0	1,333.7
					Total	**1,333.7**
Mira Trucking						
0-1	1	MT	118,838.0	1	118,838.0	4,401.4
1-4	2	MT	9,704.0	3	29,112.0	1,078.2
					Total	**5,479.6**

Appendix B
Volume Calculations - Soil (Lead Contamination Only)
Matteo & Sons, Inc. Site
Thorofare, NJ

Depth	Polygon		Area from "Belt" Shapefiles (square Feet)	Calculated Average Depth (feet)	Volume (cubic feet)	Volume (cubic yards)
Scrapyard Area (Lead)						
Commercial						
0-2	1	SY Main	153,628.0	2	307,256.0	11,379.9
			153,628.0		**Total**	**11,379.9**
2-4	1	SY North	13,533.0	2	27,066.0	1,002.4
			13,533.0		**Total**	**1,002.4**
Open Field/Waste Disposal						
Commercial (Lead)						
0-2	1	OF North	27,017.0	2	54,034.0	2,001.3
	2	Smelt North	16,879.0	2	33,758.0	1,250.3
	3	Smelt South	13,442.0	2	26,884.0	995.7
	2	OF South	4,346.0	2	8,692.0	321.9
	3	OF East	4,448.0	2	8,896.0	329.5
	4	OF West	4,486.0	2	8,972.0	332.3
	5	OF Mid	4,245.0	2	8,490.0	314.4
	6			2	0.0	0.0
	7			2	0.0	0.0
	8			2	0.0	0.0
			74,863.0		**Total**	**5,545.4**
2-4	1	Smelt	4,828.0	2	9,656.0	357.6
				2	0.0	0.0
				2	0.0	0.0
	4	OF North	8,819.0	2	17,638.0	653.3
	5			2	0.0	0.0
	6			2	0.0	0.0
	7			2	0.0	0.0
	8			2	0.0	0.0
	9			2	0.0	0.0
	10			2	0.0	0.0
			13,647.0		**Total**	**1,010.9**
4-8	1	Smelt	3,403.0	4	13,612.0	504.1
	2	Berm Pit		4	0.0	0.0
			3,403.0		**Total**	**504.1**
Eco						
0-2	1	OF South 3	49,342.0	1	49,342.0	1,827.5

Appendix B
Volume Calculations - Soil (Lead Contamination Only)
Matteo & Sons, Inc. Site
Thorofare, NJ

Depth	Polygon		Area from "Belt" Shapefiles (square Feet)	Calculated Average Depth (feet)	Volume (cubic feet)	Volume (cubic yards)
	2	OF North	182,159.0	1	182,159.0	6,746.6
	3	OF EAST	7,766.0	1	7,766.0	287.6
	4	OF West	7,383.0	1	7,383.0	273.4
	5			1	0.0	0.0
	6			1	0.0	0.0
	7			1	0.0	0.0
			246,650.0		**Total**	**9,135.2**
Rental Home Area						
0-2	1	RH	18,005.0	2	36,010.0	1,333.7
					Total	**1,333.7**

Mira Trucking						
0-1	1	MT	118,838.0	1	118,838.0	4,401.4
1-4	2	MT	9,704.0	3	29,112.0	1,078.2
					Total	**1,078.2**

Appendix B
Volume Calculations - Soil (PCB Contamination Only)
Matteo & Sons, Inc. Site
Thorofare, NJ

Depth	Polygon		Area from "Belt" Shapefiles (square Feet)	Calculated Average Depth (feet)	Volume (cubic feet)	Volume (cubic yards)
Scrapyard Area (PCBs)						
Commercial						
0-2	1	SY East	1,962.0	2	3,924.0	145.3
	2	SY South	32,169.0	2	64,338.0	2,382.9
	3	SY Sort	2,277.0	2	4,554.0	168.7
	4	SY North	28,607.0	2	57,214.0	2,119.0
	5	Smelt A	3,231.0	2	6,462.0	239.3
			68,246.0		**Total**	**5,055.3**
2-4	1	SY North	13,533.0	2	27,066.0	1,002.4
	2	SY South	3,681.0	2	7,362.0	272.7
	3			2	0.0	0.0
			17,214.0		**Total**	**1,275.1**
Open Field/Waste Disposal						
Commercial (PCBs)						
0-2	1	Smelt	4,589.0	2	9,178.0	339.9
	2	OF East	158,985.0	2	317,970.0	11,776.7
	3	OF West	25,412.0	2	50,824.0	1,882.4
	4	Berm Pit	5,771.0	2	11,542.0	427.5
	6			2	0.0	0.0
			194,757.0		**Total**	**14,426.4**
2-4						
	2	OF South 1	4,054.0	2	8,108.0	300.3
	3	OF South 2	8,112.0	2	16,224.0	600.9
	5	OF East	3,770.0	2	7,540.0	279.3
	6	OF West	17,807.0	2	35,614.0	1,319.0
	7	Berm Pit	5,652.0	2	11,304.0	418.7
	8			2	0.0	0.0
	9			2	0.0	0.0
	10			2	0.0	0.0
			39,395.0		**Total**	**2,918.1**
4-8	1	Smelt		4	0.0	0.0
	2	Berm Pit	5,652.0	4	22,608.0	837.3
			5,652.0		**Total**	**837.3**

Appendix B
Volume Calculations - Battery Casings Mixed with Sediment
Matteo & Sons, Inc. Site
Thorofare, NJ

Depth	Area from "Belt" shapefiles (square feet)	Calculated Average Depth (feet)	Volume (cubic feet)	Volume (cubic yards)
0-1	108450	1	108,450	4,020
0-2	20680	2	41,360	1,540
0-3	26690	3	80,070	2,970

Total Sediment Volume (cubic yards) = 8,530

Appendix B
Volume Calculations - Battery Casings and Battery Casings Mixed with Municipal Waste
Matteo & Sons, Inc. Site
Thorofare, NJ

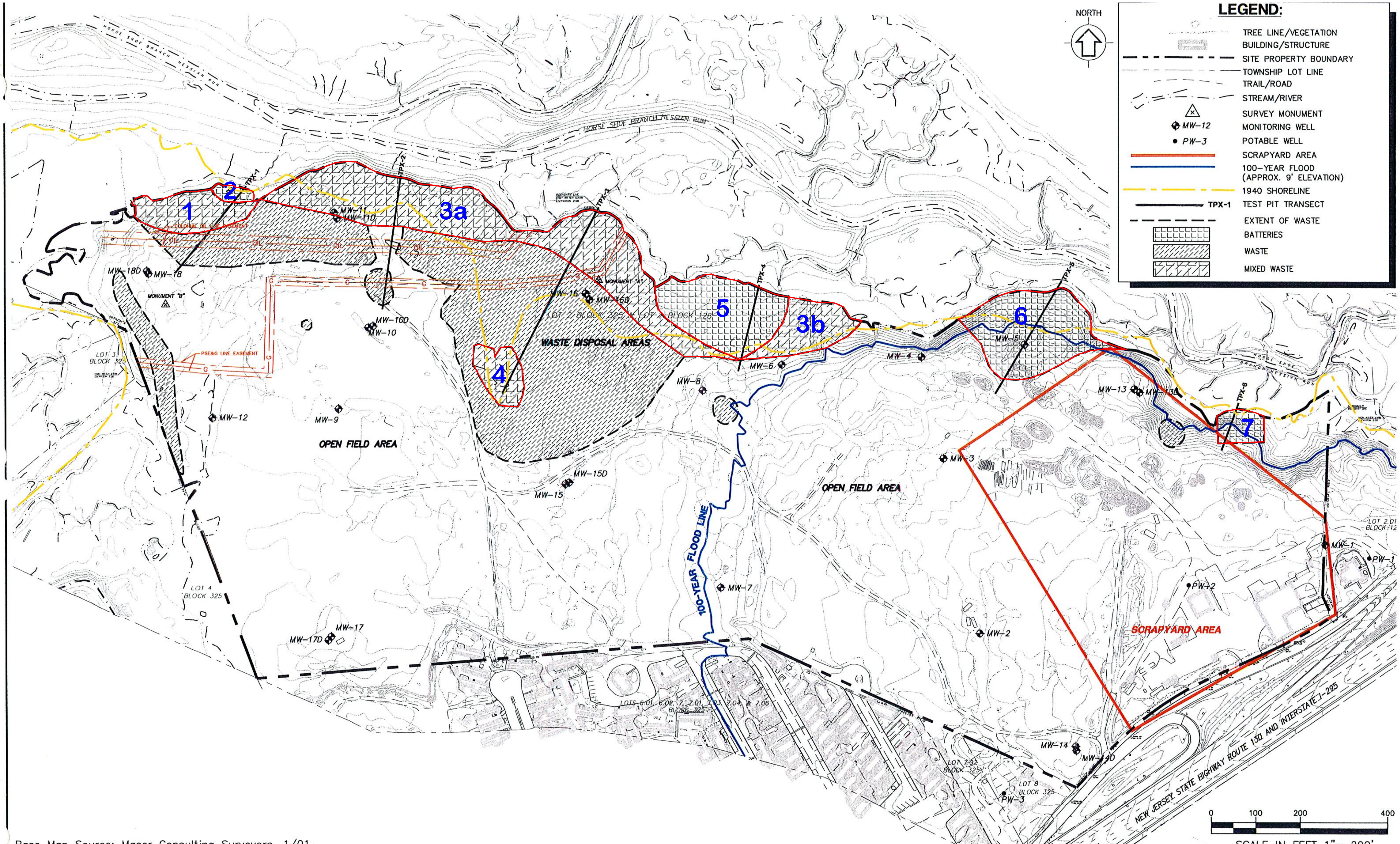
Volume of Battery Casings and Battery Casings Mixed with Municipal Waste								
Polygon	**Area from digitized DEP extent (sq ft)**	**a**	**b**	**Calculated Average Depth (feet)**	**Average Depth Based on DEP cross section:**	**Volume (cubic feet)**	**Volume (cubic yards)**	**Material**
1	18349	2.12	4.36	3.24	TPX-1	59450.76	2201.88	Mixed Casings/Refuse
2	3112	4.36	7.13	5.74	TPX-1	17862.88	661.59	Battery Casings
3a	99160			3.115	TPX-2, TPX-3	308883.4	11440.13	Mixed Casings/Refuse
3b	19585	5.38	6.05	5.715	TPX-3	111928.275	4145.49	Mixed Casings/Refuse
4	11879	3.93	1.6	2.765	TPX-3	32845.435	1216.50	Mixed Casings/Refuse
5	39106	6.25	4.55	5.4	TPX-4	211172.4	7821.20	Battery Casings
6	45807	1.89	8.39	5.14	TPX-5	235447.98	8720.30	Battery Casings
7	7361	6.91	8.87	7.89	TPX-6	58078.29	2151.05	Battery Casings

NJDEP estimation		**Our estimation**	
Total Mixed Fill Volume (cubic yards) =	22,000	Total Mixed Fill Volume (cubic yards) =	19010.00
Total Battery Casing Volume (cubic yards) =	23,000	Total Battery Casing Volume (cubic yards) =	19354.13

Volume of One Additional Foot of Soil Beneath Battery Casings and Battery Casings Mixed with Municipal Waste								
Polygon	**Area from digitized DEP extent (sq ft)**	**a**	**b**	**Calculated Average Depth (feet)**	**Average Depth Based on DEP cross section:**	**Volume (cubic feet)**	**Volume (cubic yards)**	**Material**
1	18349	2.12	4.36	1	TPX-1	18349	679.59	Mixed Casings/Refuse
2	3112	4.36	7.13	1	TPX-1	3112	115.26	Battery Casings
3a	99160			1	TPX-2, TPX-3	99160	3672.59	Mixed Casings/Refuse
3b	19585	5.38	6.05	1	TPX-3	19585	725.37	Mixed Casings/Refuse
4	11879	3.93	1.6	1	TPX-3	11879	439.96	Mixed Casings/Refuse
5	39106	6.25	4.55	1	TPX-4	39106	1448.37	Mixed Casings/Refuse
6	45807	1.89	8.39	1	TPX-5	45807	1696.56	Battery Casings
7	7361	6.91	8.87	1	TPX-6	7361	272.63	Battery Casings

Our estimation

Total Mixed Fill Volume (cubic yards) =	5517.52
Total Battery Casing Volume (cubic yards) =	3532.81



Base Map Source: Maser Consulting Surveyors, 1/01.

N.J. Department of Environmental Protection

MATTEO IRON AND METALS – GLOUCESTER COUNTY, NEW JERSEY

WASTE DISPOSAL AREAS - NATURE AND EXTENT

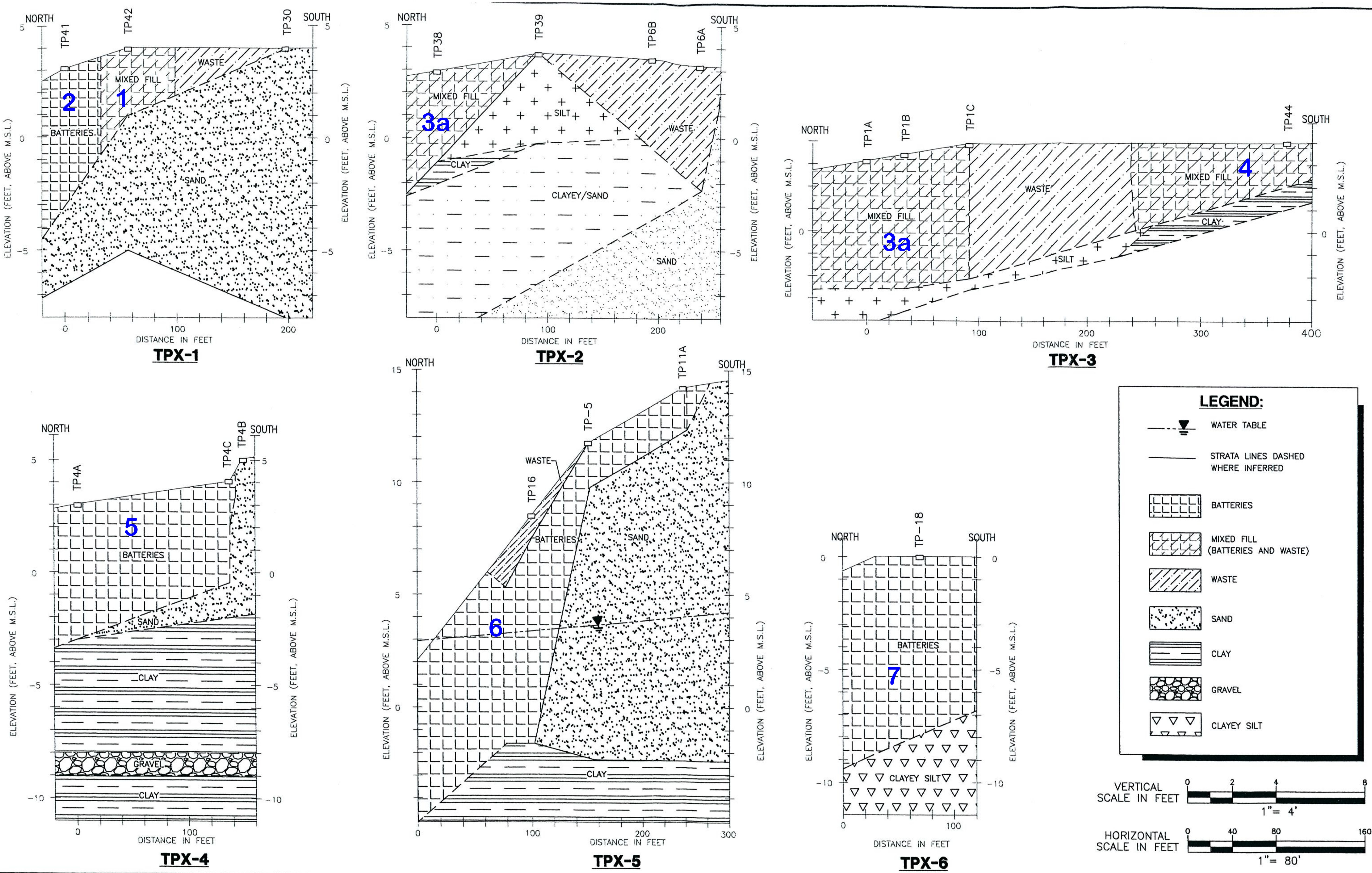
NJDEP CONTRACT No. A-85149

The Louis Berger Group, Inc.
30 Vreeland Road
Florham Park, NJ

FIGURE 4

OMAR05/WASTE-DISPOSAL-AREA.SCR

MA-RAS



N.J. Department of Environmental Protection

MATTEO IRON AND METALS – GLOUCESTER COUNTY, NEW JERSEY

WASTE DISPOSAL AREAS - CROSS SECTIONS

NJDEP CONTRACT No. A-85149

The Louis Berger Group, Inc.
30 Vreeland Road
Florham Park, NJ

FIGURE 5

Appendix C

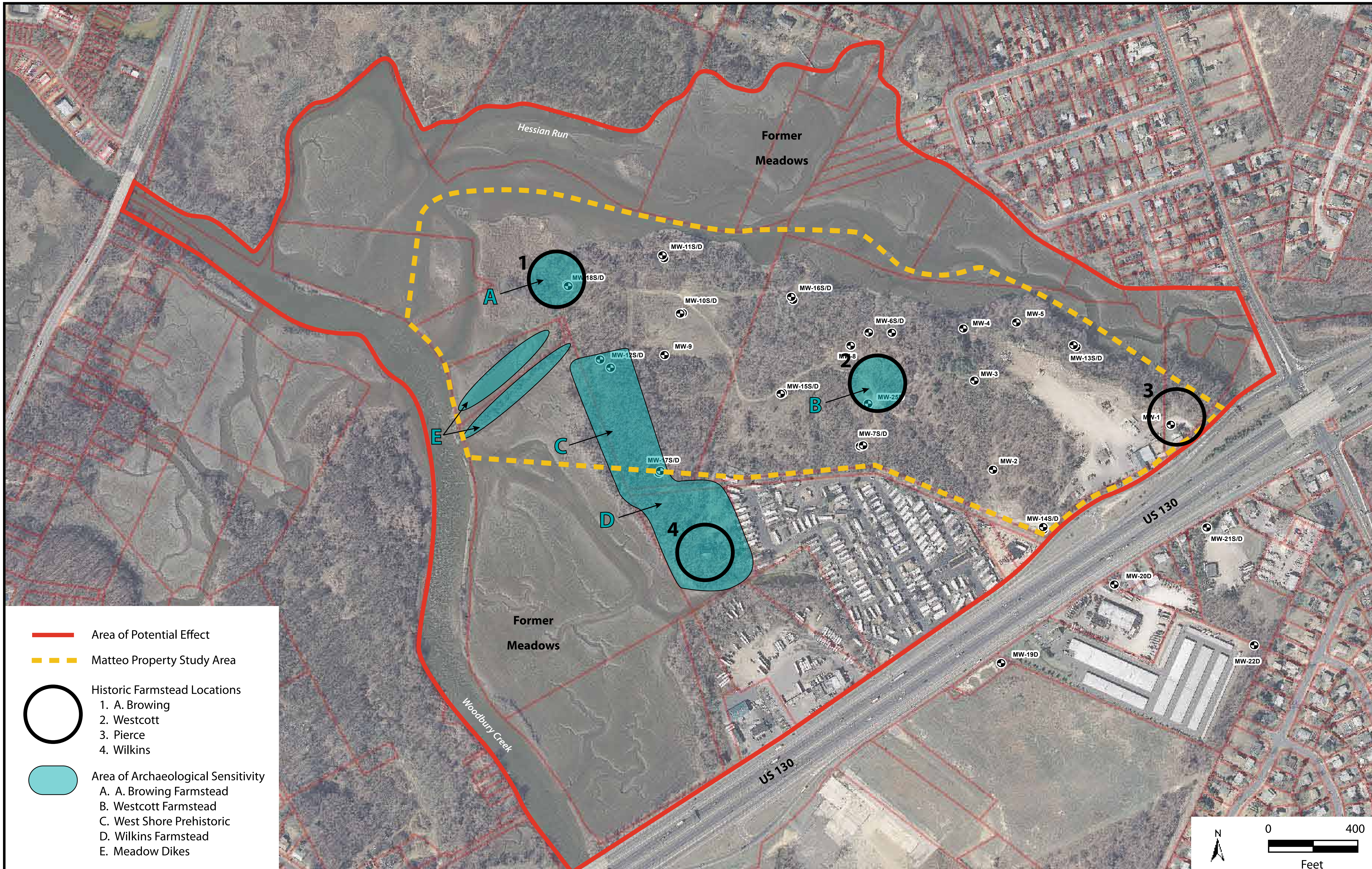


Figure 5.1. Areas of Archaeological Sensitivity.

Appendix D

Appendix D

Preliminary Climate Change Vulnerability Evaluation

Preliminary Climate Change Vulnerability Evaluation
Matteo Sons, Inc. Site
Thorofare, NJ

Potential Points of System Vulnerability		Potential System Disruption: Power Interruption	Physical Damage	Water Damage	Reduced Access	To-Be-Considered Adaptation Measures for High-Priority Vulnerabilities
Soil Excavation						
Site Operations and Infrastructure	Surface Water drainage system					Conform to existing
	Exposed machinery and vehicles		Low	Low	Low	Temporary
	Exposed dewatering equipment		Low	Low	Low	Temporary
	Liquid fuel storage and transfer		Low	Low	Low	Tie-down systems
	Fencing for access control					Conform to existing
In situ stabilization						
Site Operations and Infrastructure	Liquid fuel storage and transfer		Low	Low	Low	Tie-down systems
	Exposed machinery and vehicles		Low	Low	Low	Temporary
Engineered Containment Cell Above 100-year Flood Line						
Underground and At-Grade Components	Geomembrane liner		Low	Low		Conform to existing
	Install leachate collection system		Low	Low		Conform to existing
	Gas ventilation system		Low	Low		Conform to existing
	Geocomposite liner		Low	Low		Conform to existing
Cap/Restoration						
Underground and At-Grade Components	Vegatative soil cover		Medium	Medium		Vegatative cover below the 100-year flood zone could require extensive soil erosion control measures to be installed.
	Asphalt cap/driveway		Low	Low	Low	Conform to existing

CDM Smith

Appendix E

Appendix E

Cost Estimates

Appendix E-1
Cost Estimate for Alternative 2
Excavation, Stabilization, Onsite Containment, and Capping
Matteo & Sons, Inc. Site
Thorofare, NJ

No.	Description	Cost
	Remedial Action	
01	General requirements	$3,669,000
02	Site Work	$690,000
03	Excavation/Dreding and Handling of Source Materials	$3,104,000
04	Excavation and Handling of Lead-Contaminated Soils in OFWD Area	$167,000
05	Post-excavation sampling	$190,000
06	Ex situ Stabilization of Excavated Material	$1,270,000
07	Shoreline restoration	$919,000
08	Construction of Engineered Cell, and Spread Material and Construct Soil Cover	$6,656,000
09	Asphalt Cap in Scrapyard	$831,000
10	Connections to Public Water	$61,000
11	Overall site restoration	$100,000
12	Rental Home Area Remediation	$200,000
13	Mira Trucking Remediation	$6,196,000
	Subtotal	*$24,053,000*
	Contingency (20%)	$4,811,000
	Subtotal	*$28,864,000*
	General Contractor Bond and Insurance (5%)	$1,444,000
	Subtotal	*$30,308,000*
	General Contractor Markup (profit - 10%)	$3,031,000
	Subtotal of Remedial Action	$33,339,000
	INSPECTION AND MAINTENANCE COSTS	
14	Annual Inspection and Maintenance	$385,000
15	Annual Groundwater Monitoring	$50,000
	Present Worth for Inspection and Maintenance (30 Years)	$4,773,000
	Present Worth for Long-Term Monitoring (10 Years)	$351,000
	PRESENT WORTH	
	Total Capital Cost	**$33,339,000**
	Total O&M Cost	**$5,124,000**
	Total Present Worth	**$38,463,000**

Note: The project cost presented herein represents only feasibility study level, and is thus subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate. Expected accuracy range of the cost estimate is -30% to +50%.

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	PROJECT:	Matteo		COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032		DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA					

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

01 - General Requirements

Project Schedule

Assume the following construction schedule:

Pre-construction work plans and meetings	4	months		
Field mobilization (permits and trailer compound establishment)	0.25	months		
Site preparation (clearing and grubbing and stockpile areas)	1	months		
Berm construction	3	months		
Excavation of source materials	10	months		
Excavation of lead-contaminated soils in open field waste disposal area	1	months		
Assume incubation period for soil stabilization reagent to work does not add to construction duration as other activities will be performed simultaneously.				
Shoreline (wetland) restoration	3	months		
Construction of engineered containment cell	5	months		
Spread treated materials and construct soil cover (lagging excavation)	3	months		
Asphalt Cap/Restoration	1	months		
Final site restoration and demobilization	1	months		
Total Construction Duration	**27**	**months**	**118**	**weeks**
Project closeout	4	months		
Total Project Duration	**35**	**months**	**153**	**weeks**

General Conditions

A) Project Management and Site Supervisory

Assume the following Staff for 20 hours per week for the duration of project:

Project Manager	$150	per hour	
Project Engineer	$110	per hour	
Procurement staff (20 hours per week)	$90	per hour	
Total management and office support			$1,071,543

B) Work Plan Preparation

Estimated # of Pre-Construction Work Plans Required:			10 work plans
Estimated # of Engineer Hours Required per Work Plan:			120 hours
Project Engineer	$110	per hour	
Project Manager (half time)	$150	per hour	
Total Work Plan Preparation Cost:			$222,000

C) Permits

Permit Specialist	250	hr	$125	=	$31,250
Project Manager	120	hr	$150	=	$18,000
Total Work Plan Preparation Cost:					$49,250

D) Onsite supervisory

Assume the following full time site supervisory staff for the duration of construction:

Site Superintendent	$120	per hour	
Construction Foreman	$100	per hour	
Environmental Technician (QC)	$85	per hour	
Pickup Truck #1	$100	per day	
Pickup Truck #2	$100	per day	
per diem for superintendant	$123	per day	
Hourly total	$345.38	per hour	
	$13,815	per week	
Total Onsite Supervisory Staff for Construction Duration			$1,636,000
Subtotal General Conditions:			**$2,979,000**

Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer (SHSO), personnel protective equipment and supplies, and additional safety and air monitoring equipment/testing.

Assume PPE required for 20 people per work da for the duration of construction activities.

Total Construction Duration: 118 weeks

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

01 - General Requirements

SHSO	1180	hr	$125	=	$147,500
PPE	590	day	$10	=	$118,000
Additional Safety and Air Monitoring Equipment			10%	=	$11,800
					$277,300

Temporary Facilities

Temporary Facilities to include the field trailers, utilities, cleaning services, and office equipment and supplies.
Assume four project trailers required (2 for Contractor, 1 for EPA, and 1 shower trailer)

Trailer rental (4 trailers)	27	month	$500	=	$54,651
Electricity	27	month	$200	=	$21,860
Electricity hookup	1	LS	$10,000	=	$10,000
Phone/Internet	27	month	$80	=	$2,186
Water/Sewer	27	month	$60	=	$1,640
Cleaning service and others	27	month	$300	=	$8,198
					$98,535

Security

Assume for duration of construction requires 16-hour security guard for weekdays and 24-hour security guard for weekends.

Total Field Duration:		118 weeks			
Security trailer rental	27	month	$150	=	$4,099
Security guard	119	week	$2,600	=	$309,400
					$313,499
TOTAL COST FOR GENERAL REQUIREMENTS					**$3,669,000**

CDM Smith	PROJECT: Matteo	COMPUTED BY : KK	CHECKED BY: GC
	JOB NO.: 101995.3323.032	DATE : 6/17/2019	DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT: EPA		

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

02 - Site Work

Clearing and Grubbing

Assume clearing and grubbing the battery casing waste areas and the open field/waste disposal areas.
Assume staging area will be in the open field/waste disposal area.

Battery Casing Area		245,000 SF				
Open Field/Waste Disposal Area						
Below 100-year flood zone		450,000 SF				
Above 100-year flood zone		310,000 SF				
Total		1,005,000 SF			23 acres	
Clearing and grubbing	23	acre	$6,000	=		$138,000

Mobilization of Construction Equipment

Field mobilization (allowance)	1	LS	$50,000	=	$50,000

Construction of Sediment Dewatering Cell

Assume 10 days storage at 300 CY per day, and sediment stores at 2 feet thick.
Assume dewatering cell will be lain with 60 mil thick HDPE liner, with 6 inches of sand and then 6 inches of gravel on top.

Materials	Area		Unit price	Extended costs	
HDPE Liner	40,500	SF	$0.50	$20,250	
6 inches of gravel	750	CY	$35.00	$26,250	
6 inches of sand	750	CY	$30.00	$22,500	
Subtotal				$69,000	

Assume 10 days for completion.

Labor			
Skilled Workers (3)	$1,440	per day	
Loader, 1 1/2 CY	$1,119	per day	
Equip. Op. Heavy	$800	per day	
Duration	10	days	
Subtotal	$33,587		
Subtotal of construction of sediment dewatering cell			$102,587

Construction of Staging Area

Assume one week of storage (stabilization reagent time required) at 300 CY per day with stockpile height of 3 feet.
Assume staging area will be lain with 60 mil thick HDPE liner.

Area of construction staging area	15,920 SF		
HDPE Liner	$0.50	per SF	
Subtotal	$7,960		

Assume output of 2,750 SF per day.

Labor			
Skilled Workers (3)	$1,200	per day	
Duration	6	days	
Subtotal	$6,947		
Subtotal for construction of staging area			$14,907

Surveying

Survey would be conducted both prior to and after excavation and after site restoration
Surveyor onsite during excavation and backfill period (for depth verification, quantity measurement, waste char. samples, final grading)

Total Surveying Duration:		82	weeks		
Professional Surveyor	40	hr	$120	=	$4,800
Surveyor	821	hr	$75	=	$61,552
Assistant surveyor	821	hr	$65	=	$53,345
Submittals	1	LS	$20,000	=	$20,000
Subtotal for surveying					$139,696

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

02 - Site Work

Erosion Control						
Total Construction Duration:		118 weeks				
Length of Erosion Measure						
Along source materials		3500 LF				
Along the lead-contaminated open field/waste areas		4050 LF				
Total length		7550 LF				
Assume daily output of silt fencing at 1,300 LF and hay bales at 2,500 LF.						
Erosion control measure Installation	71	hr	$100	=	$7,062	
Silt fence	7550	LF	$1.82	=	$13,741	
Hay bale	7550	LF	$13.65	=	$103,058	
Maintenance	118	week	$500	=	$59,205	
Subtotal for erosion controls					$183,066	
Decontamination						
Assume decontamination pad required during construction duration only.						
Duration for Excavation			44 weeks			
Construction of Decon Pad	1	LS	$10,000	=	$10,000	
Decontamination operation						
Assume 2 workers for 2 hours per day to perform equipment decontamination on-site including T&D trucks.						
Laborer	441	hr	$58	=	$25,559	
Laborer	441	hr	$58	=	$25,559	
Subtotal for decontamination					$61,117	
TOTAL COST FOR SITE WORK					**$690,000**	

CDM Smith	PROJECT: Matteo	COMPUTED BY : KK	CHECKED BY: GC		
	JOB NO.: 101995.3323.032	DATE : 6/17/2019	DATE CHECKED: 6/17/2019		
CDM Federal Programs Corporation	CLIENT: EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

03 - Excavation/Dredging and Handling of Source Materials

Construction of Earth Embankment - Berm

A) Soil volume for construction of an earth embankment along outer boundary of sediment excavation area						
Length			3,000 ft			
Height			7 ft			
Top width			10 ft			
Bottom width (1:2 side slope)			38 ft			
In place volume			18,667 BCY			
Common fill volume (25% swell factor)			23,334 LCY			
Common fill cost	23,334	LCY	$21	=	$491,000	
B) Impermeable layer to prevent contamination of earth embankment						
Length			3,000 ft			
Sloping height			16 ft			
Total area			46,957 SF			
Impermeable layer cos	46,957	SF	$1.84	=	$87,000	
C) Equipment & Labor Costs						
Assume 400 CY/day production rate for berm construction						
Total berm construction			=	58 days		12 weeks
						3 months
Equipment and Crew						
Loader, 1 1/2 CY				$1,119 per day		
Equip. Op. Heavy				$800 per day		
Dump Truck (2)				$1,469 per day		
Truck Dr. medium (2)				$1,212 per day		
Bull dozer				$1,751 per day		
Equip. Op. Heavy				$800 per day		
Compaction Roller				$568 per day		
Equip. Op. Heavy				$800 per day		
Laborer (Semi-Skilled)				$612 per day		
Laborer (Semi-Skilled)				$612 per day		
Excavation Crew Unit Cost				$9,743 per day		
Equipment and Labor					$569,000	
Subtotal berm construction cost					**$1,147,000**	

Excavation of Source Materials (Sediment, Battery Casings, and Battery Casings mixed with waste)

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)		
Assume 25% volume increase of after excavation		
Assume cutbacks are needed on both sides and average depth of excavation is 4 feet.		
	in-place	excavated
Sediment	8,600 BCY	10,750 LCY
Battery casings	38,500 BCY	38,500 LCY
1 foot soil beneath battery casing	9,100 BCY	11,375 LCY
B) Production rates		
Production rate for excavation of sediment and battery casings with waste		300 CY/day
Assume excavation is performed concurrently with segregation.		
Assuming sediment will be air dried for three weeks.		
Total excavation		187 days
Total dewatering for sediments		15 days
Total excavation and dewatering period, work weeks		40 weeks
Total excavation and dewatering period, work months		10 months
C) Excavation Labor/Equipment Costs		

CDM Smith	PROJECT:	Matteo	COMPUTED BY : KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE : 6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA			

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup			
03 - Excavation/Dredging and Handling of Source Materials			
Excavating and segregation Crew			
Excavator, Hydraulic, 2 1/2 CY	$2,000 per day		
Equip. Op. Heavy	$800 per day		
Dump Truck (2)	$1,469 per day		
Truck Dr. medium (2)	$1,212 per day		
Bull dozer	$1,751 per day		
Equip. Op. Heavy	$800 per day		
Laborer (Semi-Skilled)	$612 per day		
Laborer (Semi-Skilled)	$612 per day		
Excavation and Waste Segregation Crew Unit Cost	$9,256 per day		
Subtotal excavation cost		**$1,873,000**	
D) Maintenance of dewatering cell			
Duration:	44 days		
Loader, 1 1/2 CY	$1,119 per day		
Equip. Op. Heavy	$800 per day		
	$1,919 per day		
Subtotal dewatering operation cost		**$84,000**	
TOTAL COST FOR EXCAVATION AND HANDLING OF SOURCE MATERIALS			**$3,104,000**

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK		**CHECKED BY:** GC	
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019		**DATE CHECKED:** 6/17/2019	
CDM Federal Programs Corporation	**CLIENT:** EPA				
Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup					
04 - Excavation and Handling of Lead-Contaminated Soils in OFWD area					
Assume lead-contaminated soils in open field/waste disposal area also include lead-contaminated soils with PCB contamination					
Excavation of Open Field/Waste Disposal Areas					
A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)					
Assume 25% volume increase of after excavation					
		in-place		excavated	
Open Field/Waste Disposal lead-contaminated soils above commercial PRG		**7,100**	BCY	8,875	LCY
Cut back for excavations		100	BCY	125	LCY
B) Production rates					
Assume 400 CY/day production rate for excavation of soils with waste segregation.					
Assume excavation is performed concurrently with source material excavation.					
Assume soils will be transported directly to the pugmilling and stabilization operation then to a staging area for one week incubation time.					
Total excavation in OFWD area				18	days
Total excavation period, work weeks				4	weeks
Total excavation period, work months				1	months
C) Excavation Labor/Equipment Costs					
Excavating and segregation Crew					
Excavator, Hydraulic, 2 1/2 CY		$2,000	per day		
Equip. Op. Heavy		$800	per day		
Dump Truck (2)		$1,469	per day		
Truck Dr. medium (2)		$1,212	per day		
Bull dozer		$1,751	per day		
Equip. Op. Heavy		$800	per day		
Laborer (Semi-Skilled)		$612	per day		
Laborer (Semi-Skilled)		$612	per day		
Excavation and Waste Segregation Crew Unit Cost		$9,256	per day		
TOTAL FOR EXCAVATION AND HANDLING OF CONTAMIMATED SOIL IN OFWD				**$167,000**	

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

05 - Post Excavation Sampling

Assume one sample per 900 square feet.

Surface area of source materials - battery casings	245,000	SF
Surface area of source materials - sediment	155,820	SF
Surface area of lead-contaminated soils in OFWD	74,863	SF
Total Excavation Surface Area	475,683	SF
Number of samples for TAL metal analysis	529	

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	529	EA	$ 120	$ 63,480
Sampling planning and Sample collection cost	529	EA	$ 200	$ 105,800
Sample reporting	1	LS	$ 20,000	$ 20,000
TOTAL FOR POST EXCAVATION SAMPLING				**$ 190,000**

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

06 - Ex situ Stabilization of Excavated Material

Ex Situ Stabilization -- Treatment Labor/Equipment Costs

Assume 2.0% w/w dosage of reagent to the mass of soil/sediment on a dry basis.
Assume excavation, stabilization, and soil cover construction time overlap.
Assume only soils above 800 mg/kg are stabilized.

Material Costs					
Lead-contaminated soils in open field/waste disposal area		8,875 LCY		7,100	ECY
Total contaminated material volume				7,100	ECY
Soil Bulk Density (assumption)		90 lb/cubic foot			
Mass of Soil to Treat		17,253,000 lbs			
Total reagent needed		345,060 lbs of reagent			
Total Reagent Cost		$2 per pound		**$690,120**	
Labor Costs					
Pug Mill Mobilization/Demob (Allowance)			$20,000		
Material Processing	7,100 CY	$75 =		**$552,500**	
Treated material sampling and analysis					
One sample for every 500 cubic yards of treated material and material brought onsite, analyzed for full parameters					
including sieve analyses, moisture content, chemical compounds, and Ra-226:					
Sample Analysis fee		$1,500 per sample			
Treated Material Samples Required:		14 samples			
20% QC for duplicates		3 samples			
Subtotal		$25,560			
Environmental technician to collect samples	$85 hr				
Subtotal for Environmental Technician at 0.5 hr per sample		$724			
Shipping Cost (assume 70 shipments)		$284			
Treated Materials Testing and Sampling Costs:			**$26,568**		
TOTAL EX SITU TREATMENT COSTS				**$1,270,000**	

CDM Smith
CDM Federal Programs Corporation

PROJECT: Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC	
JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019	
CLIENT: EPA			

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

07 - Shoreline Restoration

A) Backfill volume and material costs for sediment							
Backfill will restore shoreline to pre-impacted grades.							
Assume backfill will be taken from fill brought in for berm construction.							
Areal extent of sediment source materials to be excavated					155,900 SF		
Areal extent of battery casings source materials to be excavated					245,000 SF		
Shoreline length after excavation of battery casing and mixed waste					3,000 LF		
Backfill volume for shoreline slope (2H:1V)					5,444 BCY		
Assume 1 foot of clean material backfilled					400,900 CF		
Backfill volume for excavated area					14,850 BCY		
Total backfill volume for shoreline			20,294 BCY				
			25,370 LCY				
Volume from earth berm			18,667 BCY				
Therefore, additional common fill needs to be purchased for shoreline restoration.							
Extra common fill needed	1,627	BCY					
Common fill	2,034	LCY	$21	=		$42,720	
Subtotal for Backfill						**$42,720**	
B) Backfill Labor/Equipment Costs							
Assume 300 CY/day production rate for backfill							
Total shoreline backfill duration		=	85 days				
			17 weeks				
			3 months				
Long reach excavator					$1,751 per day		
Long reach excavator					$1,751 per day		
Equip. Op. Heavy					$800 per day		
Dump Truck (2)					$1,469 per day		
Truck Dr. medium (2)					$1,212 per day		
Equip. Op. Heavy					$800 per day		
Laborer (Semi-Skilled)					$612 per day		
Laborer (Semi-Skilled)					$612 per day		
Shoreline Backfill Crew Unit Cost					$9,008 per day		
Subtotal for Equipment and Labor						**$762,000**	
C) Shoreline erosion control costs							
Assume the area of shoreline slope need to be seeded and maintained.						46,957 SF	
Assume excavations along waste require geofabric installation.							
Materials							
Geofabric		46,957 SF			1.84	$86,500	
Installation of wetland seed						$10,000	
One year of maintenance						$17,000	
Subtotal for materials						**$113,500**	
TOTAL FOR SHORELINE RESTORATION							**$919,000**

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
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CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

08 - Construction of Engineered Cell, and Spread Material and Construct Soil Cover

Treated material to be spread below the 100-year flood zone is material excavated from the OFWD, Rental Home area, and Willow Woods.
Assume excavated materials will be pugmilled and spread out in the open field/waste disposal area. The material will be contained under a soil cover.
Assume treated waste will be spread out over areas above and below the 100-year flood zone.

A) Total contaminated material volume			compacted, 20% reduction	
Source materials - sediment	10,750	LCY	8,600	ECY
Source materials - battery casings	38,500	LCY	38,500	ECY
Soil Beneath Battery Casings	11,375	LCY	9,100	ECY
Lead-contaminated soils in open field/waste disposal area	8,875	LCY	7,100	ECY
Soils from excavation cutbacks	125	LCY	100	ECY
Willow Woods soils	19	LCY	15	ECY
Rental Home soils	1,688	LCY	1,350	ECY
Total			64,765	ECY
Backfill for treated materials and Clean Soil Cap parameters				
Volume of backfill below the 100-year flood zone achieves a net zero fill in the flood zone.				
Below 100-year flood zone				
Volume of treated soils and sediment	**8,565**	CY		
Minimum of 1-foot clean soil cover volume	16,667	CY		
Surface area of material	450,000	SF		
Depth of Material	0.6	feet		
B) Construction of engineered containment cell for battery casings, battery casings mixed with waste, and excavated material from Mira Trucking				
Volume of source materials and associated "soils"	**56,200**	CY		
Surface area available above the 100-year flood zone to use for cell	260,000	SF	6	acres
Depth of material	5.8	feet		
Assume using soil excavated from the containment cell area to build a berm around the containment cell and to provide cover for containment cell and open field area				
Perimeter of the cell	2,128	feet		
Volume of soil for the berm (outside slope 2:1)	7,174	cubic feet	266	CY
Volume of common fill for 2 foot cover on containment cell	527,117	cubic feet	19,523	CY
Volume of topsoil for 0.5 foot cover on containment cell	131,779	cubic feet	4,881	CY
Excavation of Area for engineered cell				
Excavation depth	5.0	feet		
Total volume to excavate for area of containment cell	**48,200**	**CY**		
Assume production rate of 500 CY for excavation.				
Duration of excavation	97	days		
Total labor/equipment costs for excavation	$897,867			
Temporarily stockpile the excavated soil for later use				
Bull dozer	$1,751	per day		
Equip. Op. Heavy	$800	per day		
Compaction Roller	$568	per day		
Equip. Op. Heavy	$800	per day		
Laborer (Semi-Skilled)	$612	per day		
Laborer (Semi-Skilled)	$612	per day		
Cost for excavation	$498,890			
Placement of materials in engineered cell				
Duration for Receiving Source Materials	187			
Assume same crew as excavation.				
Costs for Consolidating Waste Materials in Cell	$963,493			

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

08 - Construction of Engineered Cell, and Spread Material and Construct Soil Cover

Construction of Engineered Cell (costs based on a comparable project)					
It is assumed that excavation of source materials and placement will also happen concurrently.					
LLDPE Geomembrane for liner	283,825	SF	$0.95	=	$269,634
Install of leachate collection system	260,000	SF	$0.50	=	$130,000
Sand drainage layer (1 foot)	9,630	CY	$52.21	=	$502,763
Geotextile below waste	260,000	SF	$0.88	=	$228,800
Placement of the materials	159	day	$3,920	=	$623,280
Geotextile above the waste	260,000	SF	$0.88	=	$228,800
Install gas venting system	1	LS	$632,763	=	$632,763
Install LLDPE Cover	283,825	SF	$0.88	=	$249,766
Install Geocomposite Liner	283,825	LS	$0.54	=	$153,266
Spread 2-foot of soil (use soil from excavation of this	39	days	$9,743	=	$380,425
Top soil	4881	CY	$40	=	$195,229
Spread top soil	8	days	$9,743	=	$79,255
Hydroseed	283,825	SF	$0.08	=	$22,706
TOTAL FOR CONSTRUCTION OF ENGINEERED CELL:				**$6,056,937**	
Estimated duration for construction of containment cell (exclude filling and closing the cell)					97 days

C) Construction of soil cover in the Open Field/Waste Disposal area

Assume soil cover will consist of 1 foot of common fill and 0.5 foot of topsoil (for vegetation).

Material Costs

Assume soil excavated from the area for engineered containment cell will be used for cover at the open field/waste disposal area with PCB contamination and soils with lead concentrations above the ecological PRG. Erosion control measure will be installed.

Common fill needed		16,667	CY		
Volume excavated for cell and leftover after cap construction.		28,677	CY		
Top soil	8,334	CY	$40	=	$333,360

Labor Costs

Backfill and Compaction Labor/Equipment Costs

Assume transport of material is included with excavation.
Assume production rate of 600 BCY per day.
Assume side sloping volume is negligible as the treated material layer will not be over three feet.

Loader, 1 1/2 CY	$1,119	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Compaction Roller	$568	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Backfill Crew Unit Cost	$9,743	per day

Duration of Backfill with Treated Materials and Soil Cover Placement	56 days	
Total Equipment and Labor		$545,060

Hydroseed

Open field waste disposal area allowance	450,000	SF	$0.08	=	$36,000
Other erosion control allowance					$18,000
Subtotal					$54,000

TOTAL FOR CONTAINMENT CELL, SPREADING OF TREATED MATERIAL, AND SOIL COVER CONSTRUCTION: **$6,656,000**

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CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

09 - Asphalt cap in scrapyard

Crew for cap installation					
A) Asphalt Pavement Labor/Equipment Costs					
Asphalt Pavement Crew					
Labor Foreman			$2,000 per day		
Laborers (3)			$1,390 per day		
Equip. Op. Medium (2)			$1,228 per day		
Asphalt Paver			$2,345 per day		
Tandem Roller			$260 per day		
Asphalt Installation Crew Unit Cost			$7,223 per day		
Duration for Construction of Cap					
Assume crew daily output of 9,000 SF.					
Surface area already paved	=	93,000 SF			
Surface area needing to be paved	=	130,000 SF			
Duration of cap installation	=	20 days			
Total Cost for Labor/Equipment				=	$144,460
Material Costs for Cap					
Assume 6 inch crushed stone aggregate base, 2 inch binder course, and 2 inch of wearing course.					
Wearing Course	130,000 SF		$2.50	=	$325,000
Binder Course	130,000 SF		$2.50	=	$325,000
Base Course (aggregate)	2,410 CY		$15.00	=	$36,150
Total Cost for Materials				=	$686,150
TOTAL ASPHALT CAP CONSTRUCTION COST:				**$831,000**	

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CLIENT: EPA			

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

10 - Connections to Public Water

Assume 3 hook ups to city water including the residence, the Matteo facility, and the tire shop.

Trenching and piping

Assume 350 ft pipe from Residential Home to water connection for Willow Woods
Assume 720 ft pipe from the Matteo facility to water connection for Willow Woods
Assume 475 ft from the tire shop to the water connection for Willow Woods
Assume trenching production rate of 135 CY per day, backfill production rate of 400 LCY per day, and piping rate of 39 LF per day.
Assume trench is 2 feet wide and 3 feet deep.

Materials			
Piping from Residence to water connection	350	ft	
Piping from Matteo facility to water connection	720	ft	
Piping from the tire shop to water connection	475	ft	
4-inch HDPE piping	$2.25	LF	
Subtotal	$3,477		
Volume of soil to be trenched	350	BCY	
Volume of backfill required	393	LCY	
Labor and Equipment			
Equip. Op. Medium	$614	per day	
Laborer	$463	per day	
Backhoe Loader	$400	per day	
Trenching and Backfill Crew Unit Cost	$1,477	per day	
Plumber	$710	per day	
Plumber apprentice	$570	per day	
Piping Crew Unit Cost	$1,280	per day	
Duration of Trenching and Backfill work	4	days	
Duration of Piping work	40	days	
Subtotal	$57,110		
Total for Water Connections			**$61,000**

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	PROJECT: Matteo	COMPUTED BY : KK	CHECKED BY: GC		
	JOB NO.: 101995.3323.032	DATE : 6/17/2019	DATE CHECKED: 6/17/2019		
CDM Federal Programs Corporation	CLIENT: EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

12 - Rental Home Area Remediation

A) Excavation of Rental Home Property

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)						
Assume 25% volume increase of after excavation						
			in-place		excavated	
Lead-contaminated area			**1,350**	BCY	1,688	LCY
B) Production rates						
Assume 600 CY/day production rate for excavation of soils.						
Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.						
Assume soils will be transported directly to the pugmilling and stabilization operation then to a staging area for one week incubation time.						
Excavation duration					2.3	days
C) Excavation Labor/Equipment Costs						
Excavating Crew						
Excavator, Hydraulic, 2 1/2 CY			$2,000	per day		
Equip. Op. Heavy			$800	per day		
Dump Truck (2)			$1,469	per day		
Truck Dr. medium (2)			$1,212	per day		
Bull dozer			$1,751	per day		
Equip. Op. Heavy			$800	per day		
Laborer (Semi-Skilled)			$612	per day		
Laborer (Semi-Skilled)			$612	per day		
Excavation and Waste Segregation Crew Unit Cost			$9,256	per day		
Subtotal for Excavation and Handling of Contamimated Soil in Rental Home area					**$21,290**	

B) Post Excavation Sampling

Assume one sample per 900 square feet.				
Total Excavation Surface Area			18,121 SF	
Number of samples for TAL metal analysis			21	
	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	21	EA	$ 120	$ 2,520
Sampling planning and Sample collection cost	21	EA	$ 200	$ 4,200
Sample reporting	1	LS	$ 5,000	$ 5,000
Subtotal for PostExcavation Sampling				**$ 11,720**

C) Ex Situ Stabilization -- Treatment Labor/Equipment Costs

Assume only 30% of the excavated volume in the Rental Home Area requires stabilization (concentrations greater than 800 ppm).
Assume 2.0% w/w dosage of reagent to the mass of soil/sediment on a dry basis.
Assume excavation, stabilization, and soil cover construction time overlap.

Material Costs						
Lead-contaminated soils greater than 800 ppm		506	LCY		405	ECY
Total contaminated material volume					405	ECY
Soil Bulk Density (assumption)		90	lb/cubic foot			
Mass of Soil to Treat		984,150	lbs			
Total reagent needed		19,683	lbs of reagent			
Total Reagent Cost		$2	per pound		**$39,366**	
Labor Costs						
Pug Mill Mobilization/Demob (Allowance)			$20,000			
Material Processing	405 CY	$75	=		**$50,375**	

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Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

12 - Rental Home Area Remediation

Subtotal Ex Situ Treatment Costs					**$90,000**
D) Rental Home Area Restoration					
Assume backfill will be to grade.					
Material Costs					
Surface area of soils to be replaced	10,000 SF				
Surface area of gravel to be replaced	8,121 SF				
Common fill	1,276	LCY	$21	=	$26,796
Gravel	180	CY	$30	=	$5,414
Top soil and hydroseed	231	LCY	$40	=	$9,259
Subtotal Material Costs			**$ 41,469**		
Labor Costs					
Backfill and Compaction Labor/Equipment Costs					
Assume same labor/equipment costs as OFWD area backfill.					
Duration of Backfill			3 day		
Total Equipment and Labor for Backfill and Compaction			$29,230		
Topsoil Tilling Labor/Equipment Costs					
Assume topsoil will be tilled to six inches.					
Assume production rate of 270,000 square feet.					
Loader-Backhoe			$300 per day		
Equip. Op. Light			$590 per day		
Topsoil Tilling Crew Unit Cost			$890 per day		
Duration of soil cover tilling			1 day		
Total Equipment and Labor for Topsoil Tilling			$890		
Assume hydroseeding of lawn mix.					
Assume production rate of 44,000 square feet.					
Laborer			$464 per day		
Equip. Op. Medium			$620 per day		
Truck Dr. heavy			$1,500 per day		
Hydromulcher (3000 gal)			$400 per day		
Truck Tractor (200 H.P)			$450 per day		
Hydroseeding Crew Unit Cost			$3,434 per day		
Duration of hydroseeding			1 days		
Total Equipment and Labor for Seeding			$3,434		
Subtotal Labor Costs			**$ 33,554**		
Subtotal for Restoration for Rental Home area					**$76,000**
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION IN RENTAL HOME AREA					**$200,000**

CDM Smith

CDM Federal Programs Corporation

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CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

13 - Mira Trucking Remediation

A) Excavation of Mira Trucking

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Lead-contaminated area	**11,200**	BCY	14,000	LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.

Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.

Assume soils will be transported to the containment cell area.

Excavation duration 19 days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Subtotal for Excavation and Handling of Contamimated Soil in Mira Trucking **$173,094**

B) Post Excavation Sampling

Assume one sample per 900 square feet.

Total Excavation Surface Area 151,549 SF

Number of samples for TAL metal analysis 169

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	169	EA	$ 120	$ 20,280
Sampling planning and Sample collection cost	169	EA	$ 200	$ 33,800
Sample reporting	1	LS	$ 5,000	$ 5,000

Subtotal for Post Excavation Sampling **$ 59,080**

C) Offsite transportation and disposal

Transportation and disposal costs

a) Quantity calculation based on data from the RI Addendum.

b) Assumes 25% additional volume to account for bulking between bank and loose cubic yards of soil.

c) Assumes 1.6 tons per CY for the materials.

d) Assumes debris to be less than 3'x3'x3'

e) Assumes Subtitle C landfill would be in Ohio (Envirosafe).

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Lead-contaminated soils	11,200	14,000	18,000	$295	$5,310,000
Total					**$5,310,000**

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
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CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

13 - Mira Trucking Remediation

Labor and equipment costs for loading the truck for offsite disposal						
Assume 25 trucks (22 tons) working per day for offsite shipment.						
Time for loading the material for offsite disposal					26 days	
Excavator, Hydraulic, 2 CY		$1,800 per day				
Equip. Op. Heavy		$800 per day				
Laborer (Semi-Skilled)		$612 per day				
Laborer (Semi-Skilled)		$612 per day				
Total rate per day		$3,824 per day				
Subtotal for labor and equipment		**$99,424**				
Total for transportation and disposal for Mira Trucking						**$5,409,424**
D) Mira Trucking Restoration						
Assume backfill including common fill and 6-inches of gravel will be to grade.						
Material Costs						
Surface area of soils to be replaced		151,549 SF				
Common fill	11,193	LCY	$21	=		$235,053
Gravel	2,807	CY	$30	=		$84,210
Subtotal Material Costs				**$ 319,263**		
Labor Costs						
Backfill and Compaction Labor/Equipment Costs						
Assume same labor/equipment costs as OFWD area backfill.						
Duration of Backfill			24 day			
Total Equipment and Labor for Backfill and Compaction				**$ 233,840**		
Subtotal for Restoration at Mira Trucking						**$554,000**
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION AT MIRA TRUCKING						**$6,196,000**

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC
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CDM Federal Programs Corporation	**CLIENT:** EPA		

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

14 - Inspection and Maintenance

A) Inspection of Cover						
Assume annual inspection of soil cover for a default period of 30 years						
Annual allowance for inspection and an annual report						$10,000
B) Periodic pumping and disposal of leachate						
Assume once per month to pump leachate from the onsite containment cell and dispose offsite						
Annual allowance for leachate collection and disposal						$150,000
C) Maintenance of Backfill and Cover of Consolidation Pile						
Assume 3% cap and backfill costs for maintenance every year for a default period of 30 years						
Annual average allowance for soil cover maintenance						$224,610
Total Annual Costs for Inspection and Maintenance						**$384,610**

15 - Long-term Groundwater Monitoring

Assume one event per year						
Number of monitoring points			20	monitoring points		
Number of samplers			3	samplers		
Number of 10-hour workdays			5	days		
Sampling Project Planning						
Project Manager	4	hr	$150	=	$	600
Engineer	8	hr	$110	=	$	880
Scientist	8	hr	$100	=	$	800
Procurement	5	hour	$90	=	$	450
Field Sampling						
Field Tech 1	100	hour	$85	=	$	8,500
Geologist	50	hour	$110	=	$	5,500
Per diem	15	day	$181	=	$	2,715
Car rental	12	day	$95	=	$	1,140
Equipment & PPE	5	day	$300	=	$	1,500
Shipping	5	day	$300	=	$	1,500
Misc	5	day	$100	=	$	500
Sampling Analysis (includes QC samples)						
VOCs	24	ea	$150	=	$	3,600
TAL Metals	24	ea	$250	=	$	6,000
Reporting						
Project manager	8	hour	$150	=	$	1,200
Scientist	24	hour	$100	=	$	2,400
QA/QC	4	hour	$110	=	$	440
Data validation	24	hr	$150	=	$	3,600
Tabulate the data and prepa	1	LS	$3,000	=	$	3,000
Prepare the data report	1	LS	$5,000	=	$	5,000
Clerk	8	hour	$75	=	$	600
Total Annual Costs for Long-term Monitoring				=		**$49,925**

Appendix E-1
Cost Estimate for Alternative 2 - Excavation, Stabilization, Onsite Containment, and Capping

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 2 - Individual Cost Item Backup

Present Worth Calculation for Inspection and Maintenance and Long-term Monitoring Costs

This is a recurring cost every year.		
This discount factor is (P/A,i,n)		
P = Present Worth		
A = Annual amount		
i = interest rate	7%	
n = number of years	30	
n = number of years	10	

$$P = A \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

The multiplier for (P/A) for 30 years =	**12.4**	
The multiplier for (P/A) for 10 years =	**7.0**	
TOTAL INSPECTION AND MAINTENANCE COST:		**$4,773,000**
TOTAL MONITORING COST:		**$351,000**

Appendix E-2
Cost Estimate for Alternative 3
Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping
Matteo & Sons, Inc. Site
Thorofare, NJ

No.	Description	Cost
	Remedial Action	
01	General requirements	$3,199,000
02	Site Work	$638,000
03	Excavation/Dredging and Handling of Sediment and Battery Casing Waste	$3,104,000
04	Transportation and Disposal	$29,342,000
05	Excavation and Handling of Lead-Contaminated Soils in OFWD area	$167,000
06	Post-excavation sampling	$190,000
07	Ex situ Stabilization of Excavated Material	$1,270,000
08	Shoreline restoration	$919,000
09	Spread Material and Construct Soil Cover	$1,283,000
10	Asphalt Cap in Scrapyard	$831,000
11	Connections to Public Water	$61,000
12	Overall site restoration	$100,000
13	Rental Home Area Remediation	$200,000
14	Mira Trucking Remediation	$6,196,000
	Subtotal	*$47,500,000*
	Contingency (20%)	$9,500,000
	Subtotal	*$57,000,000*
	General Contractor Bond and Insurance (5%)	$2,850,000
	Subtotal	*$59,850,000*
	General Contractor Markup (profit - 10%)	$5,985,000
	Subtotal of Remedial Action	$65,835,000
	INSPECTION AND MAINTENANCE COSTS	
15	Annual Inspection and Maintenance	$74,000
16	Annual Groundwater Monitoring	$50,000
	Present Worth for Inspection and Maintenance (30 Years)	$912,000
	Present Worth for Long-Term Monitoring (10 Years)	$351,000
	PRESENT WORTH	
	Total Capital Cost	**$65,835,000**
	Total O&M Cost	**$1,263,000**
	Total Present Worth	**$67,098,000**

Note: The project cost presented herein represents only feasibility study level, and is thus subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate. Expected accuracy range of the cost estimate is -30% to +50%.

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith CDM Federal Programs Corporation	PROJECT: Matteo JOB NO.: 101995.3323.032 CLIENT: EPA	COMPUTED BY : KK DATE : 6/17/2019	CHECKED BY: GC DATE CHECKED: 6/17/2019		

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

01 - General Requirements

Project Schedule							
Assume the following construction schedule:							
Pre-construction work plans and meetings				4	months		
Field mobilization (permits and trailer compound establishment)				1	months		
Site preparation (clearing and grubbing and stockpile areas)				1	months		
Berm construction				3	months		
Excavation/dredging of sediment, battery casings, and soil beneath battery casings wi				10	months		
Excavation of lead-contaminated soils in open field waste disposal area				1	months		
Assume incubation period for soil stabilization reagent to work does not add to construction duration as other activities will be performed simultaneously.							
Shoreline (wetland) restoration				3	months		
Spread treated materials and construct soil cover (lagging excavation)				3	months		
Asphalt Cap/Restoration				1	months		
Final site restoration and demobilization				1	months		
Total Construction Duration				**23**	**months**	**101**	**weeks**
Project closeout				4	months		
Total Project Duration				**31**	**months**	**135**	**weeks**
General Conditions							
A) Project Management and Site Supervisory							
Assume the following Staff for 20 hours per week for the duration of project:							
Project Manager		$150	per hour				
Project Engineer		$110	per hour				
Procurement staff (20 hours per week)		$90	per hour				
Total management and office support					$947,184		
B) Work Plan Preparation							
Estimated # of Pre-Construction Work Plans Required:				10	work plans		
Estimated # of Engineer Hours Required per Work Plan:				120	hours		
Project Engineer		$110	per hour				
Project Manager (half time)		$150	per hour				
Total Work Plan Preparation Cost:					$222,000		
C) Permits							
Permit Specialist	250	hr	$125		=	$31,250	
Project Manager	120	hr	$150		=	$18,000	
Total Work Plan Preparation Cost:						$49,250	
D) Onsite supervisory							
Assume the following full time site supervisory staff for the duration of construction:							
Site Superintendent		$120	per hour				
Construction Foreman		$100	per hour				
Environmental Technician (QC)		$85	per hour				
Pickup Truck #1		$100	per day				
Pickup Truck #2		$100	per day				
per diem for superintendant		$123	per day				
Hourly total		$345	per hour				
		$13,815	per week				
Total Onsite Supervisory Staff for Construction Duration					$1,391,000		
Subtotal General Conditions:					**$2,610,000**		

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer (SHSO), personnel protective equipment and supplies, and additional safety and air monitoring equipment/testing.

Assume PPE required for 20 people per work da for the duration of construction activities.

Total Construction Duration: 101 weeks

SHSO	1010	hr	$125	=	$126,250
PPE	505	day	$10	=	$101,000
Additional Safety and Air Monitoring Equipment			10%	=	$10,100
					$237,350

Temporary Facilities

Temporary Facilities to include the field trailers, utilities, cleaning services, and office equipment and supplies.

Assume four project trailers required (2 for Contractor, 1 for EPA, and 1 shower trailer)

Trailer rental (4 trailers)	23	month	$500	=	$46,452
Electricity	23	month	$200	=	$18,581
Electricity hookup	1	LS	$10,000	=	$10,000
Phone/Internet	23	month	$80	=	$1,858
Water/Sewer	23	month	$60	=	$1,394
Cleaning service and others	23	month	$300	=	$6,968
					$85,252

Security

Assume for duration of construction requires 16-hour security guard for weekdays and 24-hour security guard for weekends.

Total Field Duration: 101 weeks

Security trailer rental	23	month	$150	=	$3,484
Security guard	101	week	$2,600	=	$262,600
					$266,084

TOTAL COST FOR GENERAL REQUIREMENTS **$3,199,000**

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

02 - Site Work

Clearing and Grubbing					
Assume clearing and grubbing the battery casing waste areas and the open field/waste disposal areas.					
Assume staging area will be in the open field/waste disposal area.					
Battery Casing Area		245,000 SF			
Open Field/Waste Disposal Area					
Below 100-year flood zone		450,000 SF			
Total		695,000 SF			16 acres
Clearing and grubbing	16	acre	$6,000	=	$96,000
Mobilization of Construction Equipment					
Field mobilization (allowance)	1	LS	$50,000	=	$50,000
Construction of Sediment Dewatering Cell					
Assume 10 days storage at 300 CY per day, and sediment stores at 2 feet thick.					
Assume dewatering cell will be lain with 60 mil thick HDPE liner.					
Materials	Area		Unit Price	Extended costs	
HDPE Liner	40,500	SF	$0.50	$20,250	
6 inches of gravel	750	CY	$35.00	$26,250	
6 inches of sand	750	CY	$30.00	$22,500	
Subtotal				$69,000	
Assume 10 days for completion.					
Labor					
Skilled Workers (3)		$1,440	per day		
Loader, 1 1/2 CY		$1,119	per day		
Equip. Op. Heavy		$800	per day		
Duration		10	days		
Subtotal		$33,587			
Subtotal of construction of sediment dewatering cell					$102,587
Construction of Staging Area					
Assume one week of storage (stabilization reagent time required) at 300 CY per day with stockpile height of 3 feet.					
Assume staging area will be lain with 60 mil thick HDPE liner.					
Area of construction staging area		15,920 SF			
HDPE Liner		$0.50	per SF		
Subtotal		$7,960			
Assume output of 2,750 SF per day.					
Labor					
Skilled Workers (3)		$1,200	per day		
Duration		6	days		
Subtotal		$6,947			
Subtotal for construction of staging area					$14,907

Appendix E-2

Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

02 - Site Work

Surveying					
Survey would be conducted both prior to and after excavation and after site restoration					
Surveyor onsite during excavation and backfill period (for depth verification, quantity measurement, waste char. samples, final grading)					
Total Surveying Duration:		82	weeks		
Professional Surveyor	40	hr	$120	=	$4,800
Surveyor	817	hr	$75	=	$61,252
Assistant surveyor	817	hr	$65	=	$53,085
Submittals	1	LS	$20,000	=	$20,000
Subtotal for surveying					$139,138
Erosion Control					
Total Construction Duration:		101 weeks			
Length of Erosion Measure					
Along source materials		3500 LF			
Along the lead-contaminated open field/waste areas		4050 LF			
Total length		7550 LF			
Assume daily output of silt fencing at 1,300 LF and hay bales at 2,500 LF.					
Erosion control measure Installatio	71	hr	$100	=	$7,062
Silt fence	7550	LF	$1.82	=	$13,741
Hay bale	7550	LF	$13.65	=	$103,058
Maintenance	101	week	$500	=	$50,323
Subtotal for erosion controls					$174,183
Decontamination					
Assume decontamination pad required during construction duration only.					
Duration for Excavation				44 weeks	
Construction of Decon Pad	1	LS	$10,000	=	$10,000
Decontamination operation					
Assume 2 workers for 2 hours per day to perform equipment decontamination on-site including T&D trucks.					
Laborer	441	hr	$58	=	$25,559
Laborer	441	hr	$58	=	$25,559
Subtotal for decontamination					$61,117
Total for Site Works					**$638,000**

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:** GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:** 6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

03 - Excavation/Dredging and Handling of Sediment and Battery Casing Waste

Construction of Earth Embankment - Berm

A) Soil volume for construction of an earth embankment along outer boundary of sediment excavation area

Length			3,000 ft				
Height			7 ft				
Top width			10 ft				
Bottom width (1:2 side slope)			38 ft				
In place volume			18,667 BCY				
Common fill volume (25% swell factor)			23,334 LCY				
Common fill cost	23,334	LCY	$21	=	$491,000		

B) Impermeable layer to prevent contamination of earth embankment

Length		3,000 ft			
Sloping height		16 ft			
Total area		46,957 SF			
Impermeable layer cc	46,957 SF	$1.84	=	$87,000	

C) Equipment & Labor Costs

Assume 400 CY/day production rate for berm construction

Total berm construction	=	58 days		12 weeks	
				3 months	
Equipment and Crew					
Loader, 1 1/2 CY		$1,119 per day			
Equip. Op. Heavy		$800 per day			
Dump Truck (2)		$1,469 per day			
Truck Dr. medium (2)		$1,212 per day			
Bull dozer		$1,751 per day			
Equip. Op. Heavy		$800 per day			
Compaction Roller		$568 per day			
Equip. Op. Heavy		$800 per day			
Laborer (Semi-Skilled)		$612 per day			
Laborer (Semi-Skilled)		$612 per day			
Excavation Crew Unit Cost		$9,743 per day			
Equipment and Labor			$569,000		
Subtotal berm construction cost			**$1,147,000**		

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :** KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

03 - Excavation/Dredging and Handling of Sediment and Battery Casing Waste

Excavation of Sediment, Battery Casings, and Waste

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

Assume cutbacks are needed on both sides and average depth of excavation is 4 feet.

	in-place	excavated
Sediment	8,600 BCY	10,750 LCY
Battery casings	38,500 BCY	38,500 LCY
1 foot soil beneath battery casing	9,100 BCY	11,375 LCY

B) Production rates

Production rate for excavation of sediment and battery casings with waste segregation	300 CY/day
Assume excavation is performed concurrently with segregation.	
Assuming sediment will be air dried for three weeks.	
Total excavation	187 days
Total dewatering for sediments	15 days
Total excavation and dewatering period, work weeks	40 weeks
Total excavation and dewatering period, work months	10 months

C) Excavation Labor/Equipment Costs

Excavating and segregation Crew			
Excavator, Hydraulic, 2 1/2 CY	$2,000 per day		
Equip. Op. Heavy	$800 per day		
Dump Truck (2)	$1,469 per day		
Truck Dr. medium (2)	$1,212 per day		
Bull dozer	$1,751 per day		
Equip. Op. Heavy	$800 per day		
Laborer (Semi-Skilled)	$612 per day		
Laborer (Semi-Skilled)	$612 per day		
Excavation and Waste Segregation Crew Unit Cost	$9,256 per day		
Subtotal excavation cost		**$1,873,000**	

D) Maintenance of dewatering cell

Duration:	44 days		
Loader, 1 1/2 CY	$1,119 per day		
Equip. Op. Heavy	$800 per day		
	$1,919 per day		
Subtotal dewatering operation cost		**$84,000**	
Total for Excavation and Handling of Sediment and Battery Casings			**$3,104,000**

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
CDM Federal Programs Corporation	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

04 - Transportation and Disposal

A) Transportation and Disposal Costs

a) Quantity calculation based on existing data
b) Assume 0% bulking factor for battery casings.
c) Assumes 1.6 tons per CY for the materials.
d) Assumes debris to be less than 3'x3'x3'
e) Assumes Subtitle C landfill would be in Ohio (Envirosafe).

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Source materials - battery casings	38,500	38,500	61,600	$295	$18,172,000
Source materials - sediment	10,750	13,438	17,200	$295	$5,074,000
Soil beneath battery casings	11,375	14,219	18,200	$295	$5,369,000
Total	**60,625**	**66,156**	**97,000**		**$28,615,000**

Total Transportation and Disposal Cost **$28,615,000**

B) Labor and equipment costs for loading the truck for offsite disposal

Assume 25 trucks (22 tons) working per day for offsite shipment.

Time for loading the material for offsite disposal		190 days
Excavator, Hydraulic, 2 CY	$1,800 per day	
Equip. Op. Heavy	$800 per day	
Laborer (Semi-Skilled)	$612 per day	
Laborer (Semi-Skilled)	$612 per day	
Total rate per day	$3,824 per day	

Total Cost **$726,560**

Total Transportion and Disposal Costs **$29,342,000**

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :** KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

05 - Excavation and Handling of Lead-Contaminated Soils in OFWD area

Assume lead-contaminated soils in open field/waste disposal area also include lead-contaminated soils with PCB contamination

Excavation of Open Field/Waste Disposal Areas

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Open Field/Waste Disposal Lead-contaminated soils	**7,100**	BCY	8,875	LCY
Cut back for excavations	100	BCY	125	LCY

B) Production rates

Assume 400 CY/day production rate for excavation of soils with waste segregation.

Assume excavation is performed concurrently with source material excavation.

Assume soils will be transported directly to the pugmilling and stabilization operation then to a staging area for one week incubation time.

Total excavation in OFWD area	18	days
Total excavation period, work weeks	4	weeks
Total excavation period, work months	1	months

C) Excavation Labor/Equipment Costs

Excavating and segregation Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Total for Excavation and Handling of Contamimated Soil in OFWD and Rental Home area **$167,000**

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

06 - Post-Excavation Sampling

Assume one sample per 900 square feet.				
Surface area of battery casings	245,000	SF		
Surface area of sediment	155,820	SF		
Surface area of lead-contaminated soils in OFWD	74,863	SF		
Total Excavation Surface Area	475,683	SF		
Number of samples for TAL metal analysis	529			
	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	529	EA	$ 120	$ 63,480
Sampling planning and Sample collection cost	529	EA	$ 200	$ 105,800
Sample reporting	1	LS	$ 20,000	$ 20,000
TOTAL for POST EXCAVATION SAMPLING				**$ 190,000**

Appendix E-2

Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	PROJECT: Matteo	**OMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.: 101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	CLIENT: EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

07 - Ex situ Stabilization of Excavated Material

A) Ex Situ Stabilization -- Treatment Labor/Equipment Costs

Assume 2.0% w/w dosage of reagent to the mass of soil/sediment on a dry basis.
Assume excavation, stabilization, and soil cover construction time overlap.
Assume only soils above 800 mg/kg are stabilized.

Material Costs						
Lead-contaminated soils in open field/waste disposal area		8,875	LCY		7,100	ECY
Total contaminated material volume					7,100	ECY
Soil Bulk Density (assumption)		90	lb/cubic foot			
Mass of soil to treat		17,253,000	lbs			
Total reagent needed		345,060	lbs of reagent			
Total Reagent Cost		$2	per pound		**$690,120**	
Labor Costs						
Pug Mill Mobilization/Demob (Allowance)				$20,000		
Material Processing	7,100 CY	$75		=	**$552,500**	
Treated material sampling and analysis						
One sample for every 500 cubic yards of treated material and material brought onsite, analyzed for full parameters including TCLP						
Sample Analysis fee		$1,500	per sample			
Treated Material Samples Required:		14	samples			
20% QC for duplicates		3	samples			
Subtotal		$25,560				
Environmental technician to collect samples	$85 hr					
Subtotal for Environmental Technician at 0.5 hr per sample		$724				
Shipping Cost (assume 70 shipments)		$284				
Treated Materials Testing and Sampling Costs:				**$26,568**		
Total Ex Situ Treatment Costs					**$1,270,000**	

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

08 - Shoreline Restoration

A) Backfill volume and material costs for sediment						
Backfill will restore shoreline to pre-impacted grades.						
Assume backfill will be taken from fill brought in for berm construction.						
Areal extent of sediment to be excavated				155,900 SF		
Areal extent of battery casings and mixed waste				245,000 SF		
Shoreline length after excavation of battery casing and mixed was				3,000 LF		
Volume for shoreline slope				5,444 BCY		
Assume 1 foot of clean material backfilled				400,900 CF		
Backfill volume for excavated area				14,850 BCY		
Total backfill volume for shoreline			20,294 BCY			
			25,370 LCY			
Volume from earth berm			18,667 BCY			
Therefore, additional common fill needs to be purchased for shoreline restoration.						
Extra common fill needed	1,627	BCY				
Common fill	2,034	LCY	$21	=	$42,720	
Subtotal for Backfill					**$42,720**	
B) Backfill Labor/Equipment Costs						
Assume 300 CY/day production rate for backfill						
Total shoreline backfill duration			=	85 days		
				17 weeks		
				3 months		
Long reach excavator				$1,751 per day		
Long reach excavator				$1,751 per day		
Equip. Op. Heavy				$800 per day		
Dump Truck (2)				$1,469 per day		
Truck Dr. medium (2)				$1,212 per day		
Equip. Op. Heavy				$800 per day		
Laborer (Semi-Skilled)				$612 per day		
Laborer (Semi-Skilled)				$612 per day		
Backfill Crew Unit Cost				$9,008 per day		
Equipment and Labor					**$762,000**	
C) Shoreline erosion control costs						
Assume the area of shoreline slope need to be seeded and maintained					46,957 SF	
Assume excavations along waste require geofabric installation.						
Materials						
Geofabric		46,957 SF		1.84	$86,500	
Installation of wetland seed					$10,000	
One year of maintenance					$17,000	
Subtotal for materials					**$113,500**	
Total for Shoreline Restoration						**$919,000**

Appendix E-2

Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

09 - Spread Material and Construct Soil Cover

Treated material to be spread below the 100-year flood zone is material excavated from the OFWD, Rental Home area, and Willow Woods.
Assume excavated materials will be pugmilled and spread out in the open field/waste disposal area. The material will be contained under a soil cover.
Assume treated materials will be spread out over areas above and below the 100-year flood zone.

A) Total contaminated material volume,					compacted, 20% reduction	
Lead-contaminated soils in open field/waste disposal area			8,875	LCY	7,100	ECY
Soils from excavation cutbacks			125	LCY	100	ECY
Willow Woods soils			19	LCY	15	ECY
Rental Home soils			1,688	LCY	1,350	ECY
Total					8,565	ECY
Area of backfill for treated materials						
Volume of backfill below the 100-year flood zone achieves a net zero fill in the flood zone.						
Below 100-year flood zone						
Volume of treated soils and sediment			**8,565**	CY		
Minimum clean soil cover volume			16,667	CY		
Surface area of material			450,000	SF		
Depth of Material			0.6	feet		
B) Construction of soil cover in Open Field/ Waste Disposal area						
Assume soil cover will consist of 1 foot of common fill and 0.5 foot of topsoil (for vegetation).						
Material Costs						
Common fill required for soil cover	16,670	CY	$21	=	$350,070	
Top soil and hydroseed	8,334	CY	$40	=	$333,360	
Total Material Costs					**$683,430**	
Labor Costs						
Backfill and Compaction Labor/Equipment Costs						
Assume transport of material is included with excavation.						
Assume production rate of 600 BCY per day.						
Assume side sloping volume is negligible as the treated material layer will not be over three feet.						
Loader, 1 1/2 CY			$1,119	per day		
Equip. Op. Heavy			$800	per day		
Dump Truck (2)			$1,469	per day		
Truck Dr. medium (2)			$1,212	per day		
Bull dozer			$1,751	per day		
Equip. Op. Heavy			$800	per day		
Compaction Roller			$568	per day		
Equip. Op. Heavy			$800	per day		
Laborer (Semi-Skilled)			$612	per day		
Laborer (Semi-Skilled)			$612	per day		
Backfill Crew Unit Cost			$9,743	per day		
Duration of Backfill with Treated Materials Soil Cover Placement			56	days		
Total Equipment and Labor					**$545,110**	
Hydroseed						
Open field waste disposal area allowance	450,000	SF	$0.08	=	$36,000	
Other erosion control allowance					$18,000	
Subtotal					**$54,000**	
TOTAL FOR SPREADING OF TREATED MATERIAL AND SOIL COVER CONSTRUCTION:				**$1,283,000**		

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

10 - Asphalt Cap in Scrapyard

Crew for cap installation					
A) Asphalt Pavement Labor/Equipment Costs					
Asphalt Pavement Crew					
Labor Foreman			$2,000 per day		
Laborers (3)			$1,390 per day		
Equip. Op. Medium (2)			$1,228 per day		
Asphalt Paver			$2,345 per day		
Tandem Roller			$260 per day		
Excavation and Waste Segregation Crew Unit Cost			$7,223 per day		
Duration for Construction of Cap					
Assume crew daily output of 9,000 SF.					
Surface area already paved	=	93,000 SF			
Surface area needing to be paved	=	130,000 SF			
Duration of cap installation	=	20 days			
Total Cost for Labor/Equipment				=	$144,460
Material Costs for Cap					
Assume 6 inch crushed stone aggregate base, 2 inch binder course, and 2 inch of wearing course.					
Wearing Course		130,000 SF	$2.50	=	$325,000
Binder Course		130,000 SF	$2.50	=	$325,000
Base Course (aggregate)		2,410 CY	$15.00	=	$36,150
Total Cost for Materials				=	$686,150
TOTAL CONTAINMENT CAP CONSTRUCTION COST:				**$831,000**	

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith CDM Federal Programs Corporation	PROJECT: Matteo JOB NO.: 101995.3323.032 CLIENT: EPA	COMPUTED BY : KK DATE : 6/17/2019	CHECKED BY: GC DATE CHECKED: 6/17/2019

Descriptioı FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

11 - Connections to Public Water

Assume 3 hook ups to city water including the residence, the Matteo facility, and the tire shop.

Trenching and piping

Assume 350 ft pipe from Residential Home to water connection for Willow Woods
Assume 720 ft pipe from the Matteo facility to water connection for Willow Woods
Assume 475 ft from the tire shop to the water connection for Willow Woods
Assume trenching production rate of 135 CY per day, backfill production rate of 400 LCY per day, and piping rate of 39 LF per day.
Assume trench is 2 feet wide and 3 feet deep.

Materials			
Piping from Residence to water connection	350	ft	
Piping from Matteo facility to water connection	720	ft	
Piping from the tire shop to water connection	475	ft	
4-inch HDPE piping	$2.25	LF	
Subtotal	$3,477		
Volume of soil to be trenched	350	BCY	
Volume of backfill required	393	LCY	
Labor and Equipment			
Equip. Op. Medium	$614	per day	
Laborer	$463	per day	
Backhoe Loader	$400	per day	
Trenching and Backfill Crew Unit Cost	$1,477	per day	
Plumber	$710	per day	
Plumber apprentice	$570	per day	
Piping Crew Unit Cost	$1,280	per day	
Duration of Trenching and Backfill work	4	days	
Duration of Piping work	40	days	
Subtotal	$57,110		
Total for Water Connections			**$61,000**

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
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CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

13 - Rental Home Area Remediation

A) Excavation of Open Field/Waste Disposal Areas

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Rental home lead-contaminated area	**1,350**	BCY	1,688	LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.

Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.

Assume soils will be transported directly to the pugmilling and stabilization operation then to a staging area for one week incubation time.

Total excavation in Rental Home area 2.3 days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Subtotal for Excavation and Handling of Contamimated Soil in Rental Home area **$21,290**

B) Post Excavation Sampling

Assume one sample per 900 square feet.

Total Excavation Surface Area in Rental Home area 18,121 SF

Number of samples for TAL metal analysis for Rental Home area 21

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	21	EA	$ 120	$ 2,520
Sampling planning and Sample collection cost	21	EA	$ 200	$ 4,200
Sample reporting	1	LS	$ 5,000	$ 5,000

Subtotal for PostExcavation Sampling **$ 11,720**

C) Ex Situ Stabilization -- Treatment Labor/Equipment Costs

Assume only 30% of the excavated volume in the Rental Home Area requires stabilization (concentrations greater than 800 ppm).

Assume 2.0% w/w dosage of reagent to the mass of soil/sediment on a dry basis.

Assume excavation, stabilization, and soil cover construction time overlap.

Material Costs

Lead-contaminated soils greater than 800 ppm	506	LCY	405	ECY
Total contaminated material volume			405	ECY
Soil Bulk Density (assumption)	90	lb/cubic foot		
Mass of Soil to Treat	984,150	lbs		
Total reagent needed	19,683	lbs of reagent		
Total Reagent Cost	$2	per pound	**$39,366**	

Labor Costs

Appendix E-2

Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.: 101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

13 - Rental Home Area Remediation

Pug Mill Mobilization/Demob (Allowance)					$20,000	
Material Processing	405	CY	$75	=		**$50,375**
Subtotal Ex Situ Treatment Costs						**$90,000**
D) Rental Home Area Restoration						
Assume backfill will be to grade.						
Material Costs						
Surface area of soils to be replaced	10,000	SF				
Surface area of gravel to be replaced	8,121	SF				
Common fill	1,276	LCY	$21	=		$26,796
Gravel	180	CY	$30	=		$5,414
Top soil and hydroseed	231	LCY	$40	=		$9,259
Subtotal Material Costs					**$ 41,469**	
Labor Costs						
Backfill and Compaction Labor/Equipment Costs						
Assume same labor/equipment costs as OFWD area backfill.						
Duration of Backfill			3	day		
Total Equipment and Labor for Backfill and Compaction					$29,230	
Topsoil Tilling Labor/Equipment Costs						
Assume topsoil will be tilled to six inches.						
Assume production rate of 270,000 square feet.						
Loader-Backhoe			$300	per day		
Equip. Op. Light			$590	per day		
Topsoil Tilling Crew Unit Cost			$890	per day		
Duration of soil cover tilling			1	day		
Total Equipment and Labor for Topsoil Tilling					$890	
Assume hydroseeding of lawn mix.						
Assume production rate of 44,000 square feet.						
Laborer			$464	per day		
Equip. Op. Medium			$620	per day		
Truck Dr. heavy			$1,500	per day		
Hydromulcher (3000 gal)			$400	per day		
Truck Tractor (200 H.P)			$450	per day		
Hydroseeding Crew Unit Cost			$3,434	per day		
Duration of hydroseeding			1	days		
Total Equipment and Labor					$3,434	
Subtotal Labor Costs					**$ 33,554**	
Subtotal for Restoration for Rental Home area						**$76,000**
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION IN RENTAL HOME AREA						**$200,000**

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith
CDM Federal Programs Corporation

PROJECT: Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC	
JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019	
CLIENT: EPA			

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

14 - Mira Trucking Remediation

A) Excavation of Mira Trucking

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Lead-contaminated area	**11,200**	BCY	14,000	LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.

Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.

Assume soils will be transported to the containment cell area.

Excavation duration 19 days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Subtotal for Excavation and Handling of Contamimated Soil in Mira Trucking **$173,094**

B) Post Excavation Sampling $0

Assume one sample per 900 square feet.

Total Excavation Surface Area 151,549 SF

Number of samples for TAL metal analysis 169

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	169	EA	$ 120	$ 20,280
Sampling planning and Sample collection cost	169	EA	$ 200	$ 33,800
Sample reporting	1	LS	$ 5,000	$ 5,000

Subtotal for Post Excavation Sampling **$ 59,080**

C) Offsite transportation and disposal

Transportation and disposal costs

a) Quantity calculation based on data from the RST3 report.

b) Assumes 25% additional volume to account for bulking between bank and loose cubic yards of soil.

c) Assumes 1.6 tons per CY for the materials.

d) Assumes debris to be less than 3'x3'x3'

e) Assumes Subtitle C landfill would be in Ohio (Envirosafe).

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Lead-contaminated soils	11,200	14,000	18,000	$295	$5,310,000
Total					**$5,310,000**

Labor and equipment costs for loading the truck for offsite disposal

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CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

14 - Mira Trucking Remediation

Assume 25 trucks (22 tons) working per day for offsite shipment.					
Time for loading the material for offsite disposal				26 days	
Excavator, Hydraulic, 2 CY		$1,800 per day			
Equip. Op. Heavy		$800 per day			
Laborer (Semi-Skilled)		$612 per day			
Laborer (Semi-Skilled)		$612 per day			
Total rate per day		$3,824 per day			
Subtotal for labor and equipment		**$99,424**			
Total for transportation and disposal for Mira Trucking					**$5,409,424**
D) Mira Trucking Restoration					
Assume backfill including common fill and 6-inches of gravel will be to grade.					
Material Costs					
Surface area of soils to be replaced		151,549 SF			
Common fill	11,193	LCY	$21	=	$235,053
Gravel	2,807	CY	$30	=	$84,210
Subtotal Material Costs				**$ 319,263**	
Labor Costs					
Backfill and Compaction Labor/Equipment Costs					
Assume same labor/equipment costs as OFWD area backfill.					
Duration of Backfill			24 day		
Total Equipment and Labor for Backfill and Compaction				**$ 233,840**	
Subtotal for Restoration at Mira Trucking					**$554,000**
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION AT MIRA TRUCKING					**$6,196,000**

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CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

15 - Inspection and Maintenance

Assume annual inspection of soil cover for a default period of 30 years						
Annual allowance for inspection and an annual report						$10,000
Assume 3% cap and backfill costs for maintenance every year for a default period of 30 years						
Annual average allowance for soil cover maintenance						$63,420
Total Annual Costs for Inspection and Maintenance						**$73,420**

16 - Long-term Groundwater Monitoring

Assume one event per year						
Number of monitoring points			20 monitoring points			
Number of samplers			3 samplers			
Number of 10-hour workdays			5 days			
Sampling Project Planning						
Project Manager	4	hr	$150	=	$ 600	
Engineer	8	hr	$110	=	$ 880	
Scientist	8	hr	$100	=	$ 800	
Procurement	5	hour	$90	=	$ 450	
Field Sampling						
Field Tech 1	100	hour	$85	=	$ 8,500	
Geologist	50	hour	$110	=	$ 5,500	
Per diem	15	day	$181	=	$ 2,715	
Car rental	12	day	$95	=	$ 1,140	
Equipment & PPE	5	day	$300	=	$ 1,500	
Shipping	5	day	$300	=	$ 1,500	
Misc	5	day	$100	=	$ 500	
Sampling Analysis (includes QC samples)						
VOCs	24	ea	$150	=	$ 3,600	
TAL Metals	24	ea	$250	=	$ 6,000	
Reporting						
Project manager	8	hour	$150	=	$ 1,200	
Scientist	24	hour	$100	=	$ 2,400	
QA/QC	4	hour	$110	=	$ 440	
Data validation	24	hr	$150	=	$ 3,600	
Tabulate the data and prepare figu	1	LS	$3,000	=	$ 3,000	
Prepare the data report	1	LS	$5,000	=	$ 5,000	
Clerk	8	hour	$75	=	$ 600	
Total Annual Costs for Long-term Monitoring				=		**$49,925**

Appendix E-2
Cost Estimate for Alternative 3 - Excavation, Offsite Disposal of Source Materials, Stabilization, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:** GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:** 6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FS Cost Estimate for Alternative 3 - Individual Cost Item Backup

Present Worth Calculation for Inspection and Maintenance, and Long-term Monitoring Costs

This is a recurring cost every year.
This discount factor is (P/A,i,n)
P = Present Worth
A = Annual amount

i = interest rate	7%
n = number of years	30
n = number of years	10

$$P = A \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

The multiplier for (P/A) for 30 years =	**12.4**
The multiplier for (P/A) for 10 years =	**7.0**

TOTAL INSPECTION AND MAINTENANCE COST:	**$912,000**
TOTAL MONITORING COST:	**$351,000**

Appendix E-3
Cost Estimate for Alternative 4
Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping
Matteo & Sons, Inc. Site
Thorofare, NJ

No.	Description	Cost
	Remedial Action	
01	General requirements	$3,353,000
02	Site Work	$677,000
03	Excavation/Dredging and Handling of Sediment and Battery Casing Waste	$3,104,000
04	Excavation and Handling of Lead- and PCB-Contaminated Soils in OFWD area	$544,000
05	Transportation and Disposal	$33,952,000
06	Post-Excavation sampling	$324,000
07	Shoreline restoration	$882,000
08	Open Field/Waste Disposal Area Excavation Areas Restoration	$1,025,000
09	Asphalt Cap in Scrapyard	$831,000
10	Connections to Public Water	$61,000
11	Overall site restoration	$100,000
12	Rental Home Area Remediation	$508,000
13	Mira Trucking Remediation	$6,196,000
	Subtotal	*$51,557,000*
	Contingency (20%)	$10,312,000
	Subtotal	*$61,869,000*
	General Contractor Bond and Insurance (5%)	$3,094,000
	Subtotal	*$64,963,000*
	General Contractor Markup (profit - 10%)	$6,497,000
	Subtotal of Remedial Action	$71,460,000
	INSPECTION AND MAINTENANCE COSTS	
14	Annual Inspection and Maintenance	$35,000
15	Annual Groundwater Monitoring	$50,000
	Present Worth for Inspection and Maintenance (30 Years)	$434,000
	Present Worth for Long-Term Monitoring (10 Years)	$351,000
	PRESENT WORTH	
	Total Capital Cost	**$71,460,000**
	Total O&M Cost	**$785,000**
	Total Present Worth	**$72,245,000**

Note: The project cost presented herein represents only feasibility study level, and is thus subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate. Expected accuracy range of the cost estimate is -30% to +50%.

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith CDM Federal Programs Corporation	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC	
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019	
	CLIENT:	EPA					

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

01 - General Requirements

Project Schedule

Assume the following construction schedule:

Pre-construction work plans and meetings	4	months		
Field mobilization (permits and trailer compound establishment)	1	months		
Site preparation (clearing and grubbing and stockpile areas)	1	months		
Berm construction	3	months		
Excavation/dredging of sediment, battery casings, and soil beneath battery casings	10	months		
Excavation of lead- and PCB-contaminated soils in open field waste disposal area	3	months		
Shoreline (wetland) restoration	3	months		
Restoration in open field/waste disposal area	2	months		
Asphalt Cap/Restoration	1	months		
Final site restoration and demobilization	1	months		
Total Construction Duration	**25**	**months**	**106**	**weeks**
Project closeout	4	months		
Total Project Duration	**33**	**months**	**141**	**weeks**

General Conditions

A) Project Management and Site Supervisory

Assume the following Staff for 20 hours per week for the duration of project:

Project Manager		$150	per hour	
Project Engineer		$110	per hour	
Procurement staff (20 hours per week)		$90	per hour	
Total management and office support				$988,106

B) Work Plan Preparation

Estimated # of Pre-Construction Work Plans Required:			10 work plans	
Estimated # of Engineer Hours Required per Work Plan:			120 hours	
Project Engineer		$110	per hour	
Project Manager (half time)		$150	per hour	
Total Work Plan Preparation Cost:				$222,000

C) Permits

Permit Specialist	250	hr	$125	=	$31,250
Project Manager	120	hr	$150	=	$18,000
Total Work Plan Preparation Cost:					$49,250

D) Onsite supervisory

Assume the following full time site supervisory staff for the duration of construction:

Site Superintendent	$120	per hour	
Construction Foreman	$100	per hour	
Environmental Technician (QC)	$85	per hour	
Pickup Truck #1	$100	per day	
Pickup Truck #2	$100	per day	
per diem for superintendant	$123	per day	
Hourly total	$345	per hour	
	$13,815	per week	
Total Onsite Supervisory Staff for Construction Duration			$1,472,000

Subtotal General Conditions:	**$2,732,000**

Appendix E-3

Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
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CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

01 - General Requirements

Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer (SHSO), personnel protective equipment and supplies, and additional safety and air monitoring equipment/testing.

Assume PPE required for 20 people per work day for the duration of construction activities.

Total Construction Duration:		106	weeks		
SHSO	1060	hr	$125	=	$132,500
PPE	530	day	$10	=	$106,000
Additional Safety and Air Monitoring Equipment			10%	=	$10,600
					$249,100

Temporary Facilities

Temporary Facilities to include the field trailers, utilities, cleaning services, and office equipment and supplies.

Assume four project trailers required (2 for Contractor, 1 for EPA, and 1 shower trailer)

Trailer rental (4 trailers)	25	month	$500	=	$49,150
Electricity	25	month	$200	=	$19,660
Electricity hookup	1	LS	$10,000	=	$10,000
Phone/Internet	25	month	$80	=	$1,966
Water/Sewer	25	month	$60	=	$1,474
Cleaning service and others	25	month	$300	=	$7,372
					$89,623

Security

Assume for duration of construction requires 16-hour security guard for weekdays and 24-hour security guard for weekends.

Total Field Duration:			106 weeks		
Security trailer rental	25	month	$150	=	$3,686
Security guard	107	week	$2,600	=	$278,200
					$281,886

TOTAL COST FOR GENERAL REQUIREMENTS	**$3,353,000**

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
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CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

02 - Site Work

Clearing and Grubbing

Assume clearing and grubbing the battery casing waste areas and the open field/waste excavation areas.
Assume staging area will be in the open field/waste disposal area.

Battery Casing Area		245,000 SF			
Open Field/Waste Disposal Area		397,320 SF			
Total		642,320 SF		15 acres	
Clearing and grubbing	15	acre	$6,000	=	**$90,000**

Mobilization of Construction Equipment

Field mobilization (allowance)	1	LS	$50,000	=	**$50,000**

Construction of Sediment Dewatering Cell

Assume 10 days storage at 300 CY per day, and sediment stores at 2 feet thick.
Assume dewatering cell will be lain with 60 mil thick HDPE liner.

Materials	Area		Unit price	Extended costs	
HDPE Liner	40,500	SF	$0.50	$20,250	
6 inches of gravel	750	CY	$35.00	$26,250	
6 inches of sand	750	CY	$30.00	$22,500	
Subtotal				$69,000	

Assume 10 days for completion.

Labor			
Skilled Workers (3)	$1,440	per day	
Loader, 1 1/2 CY	$1,119	per day	
Equip. Op. Heavy	$800	per day	
Duration	10	days	
Subtotal	$33,587		
Subtotal of construction of sediment dewatering cell			**$102,587**

Construction of Staging Area

Assume one week of storage (stabilization reagent time required) at 300 CY per day with stockpile height of 3 feet.
Assume staging area will be lain with 60 mil thick HDPE liner.

Area of construction staging area	15,920 SF		
HDPE Liner	$0.50	per SF	
Subtotal	$7,960		

Assume output of 2,750 SF per day.

Labor			
Skilled Workers (3)	$1,200	per day	
Duration	6	days	
Subtotal	$6,947		
Subtotal for construction of staging area			**$14,907**

Surveying

Survey would be conducted both prior to and after excavation and after site restoration
Surveyor onsite during excavation and backfill period (for depth verification, quantity measurement, waste char. samples, final grading)

Total Surveying Duration: 88 weeks

Professional Surveyor	40	hr	$120	=	$4,800
Surveyor	876	hr	$75	=	$65,712
Assistant surveyor	876	hr	$65	=	$56,950
Submittals	1	LS	$20,000	=	$20,000
Subtotal for surveying					**$147,462**

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
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CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

Erosion Control					
Total Construction Duration:		106 weeks			
Length of Erosion Measure					
Along the battery casings and sediment		3500 LF			
Along the contaminated open field/waste areas		5500 LF			
Total length		9000 LF			
Assume daily output of silt fencing at 1,300 LF and hay bales at 2,500 LF.					
Erosion control measure Installation	84	hr	$100	=	$8,418
Silt fence	9000	LF	$1.82	=	$16,380
Hay bale	9000	LF	$13.65	=	$122,850
Maintenance	106	week	$500	=	$53,246
Subtotal for erosion controls					**$200,894**
Decontamination					
Assume decontamination pad required during construction duration only.					
Duration for Excavation			52 weeks		
Construction of Decon Pad	1	LS	$10,000	=	$10,000
Decontamination operation					
Assume 2 workers for 2 hours per day to perform equipment decontamination on-site including T&D trucks.					
Laborer	522	hr	$58	=	$30,286
Laborer	522	hr	$58	=	$30,286
Subtotal for decontamination					**$70,571**
Total for Site Works					**$677,000**

CDM Smith	PROJECT: Matteo	COMPUTED BY : KK	CHECKED BY: GC
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CDM Federal Programs Corporation	CLIENT: EPA		

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

03 - Excavation/Dredging and Handling of Sediment and Battery Casing Waste

Construction of Earth Embankment - Berm

A) Soil volume for construction of an earth embankment along outer boundary of sediment excavation area

Length	3,000	ft
Height	7	ft
Top width	10	ft
Bottom width (1:2 side slope)	38	ft
In place volume	18,667	BCY
Common fill volume (25% swell factor)	23,334	LCY

Common fill cost	23,334	LCY	$21	=	$491,000

B) Impermeable layer to prevent contamination of earth embankment

Length	3,000	ft
Sloping height	16	ft
Total area	46,957	SF

Impermeable layer c	46,957	SF	$1.84	=	$87,000

B) Equipment & Labor Costs

Assume 400 CY/day production rate for berm construction

Total berm construction	=	58 days	12 weeks
			3 months

Equipment and Crew

Loader, 1 1/2 CY	$1,119 per day
Equip. Op. Heavy	$800 per day
Dump Truck (2)	$1,469 per day
Truck Dr. medium (2)	$1,212 per day
Bull dozer	$1,751 per day
Equip. Op. Heavy	$800 per day
Compaction Roller	$568 per day
Equip. Op. Heavy	$800 per day
Laborer (Semi-Skilled)	$612 per day
Laborer (Semi-Skilled)	$612 per day
Excavation Crew Unit Cost	$9,743 per day

Equipment and Labor	$569,000
Subtotal berm construction cost	**$1,147,000**

Excavation of Sediment, Battery Casings, and Waste

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

Assume cutbacks are not needed because excavations are shallow and those deeper are sloping due to the dumping of the battery casings on top of natural slope.

	in-place	excavated
Sediment	8,600 BCY	10,750 LCY
Battery casings	38,500 BCY	48,125 LCY
1 foot soil beneath battery casing	9,100 BCY	11,375 LCY

B) Production rates

Production rate for excavation of sediment and battery casings with waste segregation	300 CY/day
Assume excavation is performed concurrently with segregation.	
Assuming sediment will be air dried for three weeks.	
Total excavation	187 days
Total dewatering for sediments	15 days
Total excavation and dewatering period, work weeks	40 weeks
Total excavation and dewatering period, work months	10 months

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC	
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019	
CDM Federal Programs Corporation	**CLIENT:** EPA			
Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup				
03 - Excavation/Dredging and Handling of Sediment and Battery Casing Waste				
C) Excavation Labor/Equipment Costs				
Excavating and segregation Crew				
Excavator, Hydraulic, 2 1/2 CY		$2,000 per day		
Equip. Op. Heavy		$800 per day		
Dump Truck (2)		$1,469 per day		
Truck Dr. medium (2)		$1,212 per day		
Bull dozer		$1,751 per day		
Equip. Op. Heavy		$800 per day		
Laborer (Semi-Skilled)		$612 per day		
Laborer (Semi-Skilled)		$612 per day		
Excavation and Waste Segregation Crew Unit Cost		$9,256 per day		
Subtotal excavation cost			**$1,873,000**	
D) Maintenance of dewatering cell				
Duration:		44 days		
Loader, 1 1/2 CY		$1,119 per day		
Equip. Op. Heavy		$800 per day		
		$1,919 per day		
Subtotal dewatering operation cost			**$84,000**	
Total for Excavation and Handling of Sediment and Battery Casings				**$3,104,000**

Appendix E-3

Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup				
04 - Excavation and Handling of Lead- and PCB-Contaminated Soils in OFWD area				
Assume lead-contaminated soils in open field/waste disposal area also include lead-contaminated soils with PCB contamination				
Excavation of Open Field/Waste Disposal Areas				
A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)				
Assume 25% volume increase of after excavation				
Assume cutbacks are needed for excavations deeper than four feet.				
	in-place		excavated	
Open Field/Waste Disposal Lead-contaminated soils	**7,100**	**BCY**	8,875	LCY
Open Field/Waste Disposal PCB-contaminated (only) soils	**6,900**	**BCY**	8,625	LCY
Open Field/Waste Disposal Soils with lead above Eco PRG	**9,200**	**BCY**	11,500	LCY
Cut back for OFWD excavations (lead)	100	BCY	125	LCY
Cut back for OFWD excavations (PCBs)	200	BCY	250	LCY
B) Production rates				
Assume 400 CY/day production rate for excavation of soils with waste segregation.				
Assume excavation is performed concurrently with source material excavation.				
Total excavation			59	days
Total excavation period, work weeks			12	weeks
Total excavation period, work months			3	months
C) Excavation Labor/Equipment Costs				
Excavating and segregation Crew				
Excavator, Hydraulic, 2 1/2 CY	$2,000	per day		
Equip. Op. Heavy	$800	per day		
Dump Truck (2)	$1,469	per day		
Truck Dr. medium (2)	$1,212	per day		
Bull dozer	$1,751	per day		
Equip. Op. Heavy	$800	per day		
Laborer (Semi-Skilled)	$612	per day		
Laborer (Semi-Skilled)	$612	per day		
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day		
Total for Excavation and Handling of Contamimated Soil in Battery Casings area and OFWD			**$544,000**	

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PROJECT: Matteo
JOB NO.: 101995.3323.032
CLIENT: EPA
OMPUTED BY : KK
DATE : 6/17/2019
CHECKED BY: GC
DATE CHECKED: 6/17/2019

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

05 - Transportation and Disposal

A) Transportation and Disposal Costs

a) Quantity calculation based on existing data
b) Add 25% additional volume to account for bulking between bank and loose cubic yards for soil. For battery casings and waste, assume 0% bulking factor
c) Assumes 1.6 tons per CY for soil and waste pile debris
d) Assumes debris to be less than 3'x3'x3'
e) Assumes Subtitle C landfill would be in Ohio (Envirosafe) and Subtitle D landfill would be in Pennsylvania (Progressive Waste Solutions).
F) Assume 7% of PCB-contaminated OFWD soils is above 50 mg/kg.

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Source materials - battery casings	38,500	38,500	61,600	$295	$18,172,000
Source materials - sediment	8,600	10,750	13,800	$295	$4,071,000
Soil beneath battery casings	9,100	11,375	14,600	$295	$4,307,000
Lead-Contaminated OFWD Soils	7,100	8,875	11,400	$295	$3,363,000
OFWD Soils with lead above Eco PRG	9,200	11,500	14,800	$110	$1,628,000
Cutback soils	300	375	500	$110	$55,000
PCB-contaminated OFWD Soils (below 50mg/kg)	6,417	8,021	10,300	$110	$1,133,000
PCB-contaminated OFWD Soils (above 50mg/kg)	483	604	800	$295	$236,000
Total	**79,700**	**90,000**	**127,800**		**$32,965,000**

Total Transportation and Disposal Cost	**$32,965,000**

B) Labor and equipment costs for loading the truck for offsite disposal

Assume 25 truck (22 tons) per day for offsite shipment

Time for loading the material for offsite disposal	258	days
Excavator, Hydraulic, 2 CY	$1,800	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Total rate per day	$3,824	per day

Total Cost	**$986,592**
Total Transportion and Disposal Costs	**$33,952,000**

CDM Smith	**PROJECT:** Matteo	**OMPUTED BY :** KK		**CHECKED BY:** GC	
CDM Federal Programs Corporation	**JOB NO.:** 101995.3323.032	**DATE :** 6/17/2019		**DATE CHECKED:** 6/17/2019	
	CLIENT: EPA				
Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup					
06 - Post Excavation Sampling					
Assume one sample per 900 square feet.					
Surface area of battery casings		245,000 SF			
Surface area of sediment		155,820 SF			
Surface area of lead-contaminated soils in OFWD		74,863 SF			
Surface area of PCB-contaminated soils (only) in OFWD		165,485 SF			
Surface area of soils with lead above eco PRGs in OFWD		156,972 SF			
Total Excavation Surface Area		798,140 SF			
Number of samples for TAL metal analysis		887			
	Quantity	Unit	Unit cost	Extended Cost	
Analytical cost	887	EA	$ 120	$ 106,440	
Sampling planning and Sample collection cost	887	EA	$ 200	$ 177,400	
Sample reporting	1	LS	$ 40,000	$ 40,000	
TOTAL for POST EXCAVATION SAMPLING				**$ 324,000**	

Appendix E-3

Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:**	Matteo	**)MPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

07 - Shoreline Restoration

A) Backfill volume and material costs for sediment						
Backfill will restore shoreline to pre-impacted grades.						
Assume backfill will be taken from fill brought in for berm construction.						
Areal extent of sediment to be excavated				155,900 SF		
Areal extent of battery casings and mixed waste				245,000 SF		
Shoreline length after excavation of battery casing and mixed was				3,000 LF		
Volume for shoreline slope				5,444 BCY		
Assume 1 foot of clean material backfilled				400,900 CF		
Subtotal backfill volume for excavated area				14,850 BCY		
Total backfill volume for shoreline			20,294 BCY			
			25,370 LCY			
Volume from earth berm			18,667 BCY			
Therefore, additional common fill needs to be purchased for shoreline restoration.						
Extra common fill needed	1,627	BCY				
Common fill	2,034	LCY	$21	=	$42,720	
Subtotal for Backfill					**$42,720**	
B) Backfill Labor/Equipment Costs						
Assume 300 CY/day production rate for backfill						
Total shoreline backfill duration			=	85 days		
				17 weeks		
				3 months		
Long reach excavator				$1,751 per day		
Long reach excavator				$1,751 per day		
Equip. Op. Heavy				$800 per day		
Dump Truck (2)				$1,469 per day		
Truck Dr. medium (2)				$1,212 per day		
Equip. Op. Heavy				$800 per day		
Laborer (Semi-Skilled)				$612 per day		
Laborer (Semi-Skilled)				$612 per day		
Backfill Crew Unit Cost				$9,008 per day		
Equipment and Labor					**$762,000**	
C) Shoreline erosion control costs						
Assume the area of shoreline slope need to be seeded and maintained					46,957 SF	
Assume excavations along waste require geofabric installation.						
Materials						
Geofabric		26840 SF		1.84	$49,400	
Shoreline length		3,000 feet				
length of sloping excavation		9 feet				
Installation of wetland seed					$10,000	
One year of maintenance					$17,000	
Subtotal for materials					**$76,400**	
Total for Shoreline Restoration						**$882,000**

Appendix E-3

Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

08 - Open Field/Waste Disposal Area Excavation Areas Restoration

Assume restoration will entail backfill of one foot of common fill and half a foot of topsoil in the OFWD areas with rough grading.

Material Costs						
Excavated surface area	397,320	SF				
Common fill required for excavation	14,800	CY	$21		=	$310,800
Top soil	7,358	CY	$40		=	$294,320
Total Material Costs	22158	CY				**$ 605,120**
Labor Costs						
Backfill and Compaction Labor/Equipment Costs						
Assume transport of material is included with excavation.						
Assume production rate of 600 BCY per day.						
Assume side sloping volume is negligible as the treated material layer will not be over three feet.						
Loader, 1 1/2 CY			$1,119	per day		
Equip. Op. Heavy			$800	per day		
Dump Truck (2)			$1,469	per day		
Truck Dr. medium (2)			$1,212	per day		
Bull dozer			$1,751	per day		
Equip. Op. Heavy			$800	per day		
Compaction Roller			$568	per day		
Equip. Op. Heavy			$800	per day		
Laborer (Semi-Skilled)			$612	per day		
Laborer (Semi-Skilled)			$612	per day		
Backfill Crew Unit Cost			$9,743	per day		
Duration of Backfill			37	days		
Total Backfill and compaction						**$359,820**
Rough Grading Labor/Equipment Costs						
Assume transport of material is included with excavation.						
Assume production rate of 600 BCY per day.						
Assume side sloping volume is negligible as the treated material layer will not be over three feet.						
Equip. Op. Medium			$620	per day		
Laborer			$464	per day		
Grader (30,000 lbs)			$786	per day		
Grading Crew Unit Cost			$1,870	per day		
Duration of Rough Grading			6	days		
Total Rough Grading						**$11,220**
Hydroseed						
Open field waste disposal area allow	400,000	SF	$0.08		=	$32,000
Other erosion control allowrance						$16,000
Total hydroseeding						**$48,000**
TOTAL FOR RESTORATION IN OPEN FIELD/WASTE DISPOSAL AREA:				**$1,025,000**		

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

09 - Asphalt Cap in Scrapyard

Crew for cap installation							
A) Asphalt Pavement Labor/Equipment Costs							
Asphalt Pavement Crew							
Labor Foreman				$2,000	per day		
Laborers (3)				$1,390	per day		
Equip. Op. Medium (2)				$1,228	per day		
Asphalt Paver				$2,345	per day		
Tandem Roller				$260	per day		
Excavation and Waste Segregation Crew Unit Cost				$7,223	per day		
Duration for Construction of Cap							
Assume crew daily output of 9,000 SF.							
Surface area already paved	=	93,000	SF				
Surface area needing to be paved	=	130,000	SF				
Duration of cap installation	=	20	days				
Total Cost for Labor/Equipment						=	$144,460
Material Costs for Cap							
Assume 6 inch crushed stone aggregate base, 2 inch binder course, and 2 inch of wearing course.							
Wearing Course	130,000	SF		$2.50		=	$325,000
Binder Course	130,000	SF		$2.50		=	$325,000
Base Course (aggregate)	2,410	CY		$15.00		=	$36,150
Total Cost for Materials						=	$686,150
TOTAL CONTAINMENT CAP CONSTRUCTION COST:					**$831,000**		

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	PROJECT: Matteo	COMPUTED BY : KK		CHECKED BY: GC	
	JOB NO.: 101995.3323.032	DATE : 6/17/2019		DATE CHECKED: 6/17/2019	
CDM Federal Programs Corporation	CLIENT: EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

10 - Connections to Public Water

Assume 3 hook ups to city water including the residence, the Matteo facility, and the tire shop.

Trenching and piping

Assume 350 ft pipe from Residential Home to water connection for Willow Woods
Assume 720 ft pipe from the Matteo facility to water connection for Willow Woods
Assume 475 ft from the tire shop to the water connection for Willow Woods
Assume trenching production rate of 135 CY per day, backfill production rate of 400 LCY per day, and piping rate of 39 LF per day.
Assume trench is 2 feet wide and 3 feet deep.

Materials			
Piping from Residence to water connection	350	ft	
Piping from Matteo facility to water connection	720	ft	
Piping from the tire shop to water connection	475	ft	
4-inch HDPE piping	$2.25	LF	
Subtotal	$3,477		
Volume of soil to be trenched	350	BCY	
Volume of backfill required	393	LCY	
Labor and Equipment			
Equip. Op. Medium	$614	per day	
Laborer	$463	per day	
Backhoe Loader	$400	per day	
Trenching and Backfill Crew Unit Cost	$1,477	per day	
Plumber	$710	per day	
Plumber apprentice	$570	per day	
Piping Crew Unit Cost	$1,280	per day	
Duration of Trenching and Backfill work	4	days	
Duration of Piping work	40	days	
Subtotal	$57,110		
Total for Water Connections			**$61,000**

Appendix E-3

Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

12 - Rental Home Area Remediation

Assume lead-contaminated soils in open field/waste disposal area also include lead-contaminated soils with PCB contamination

A) Excavation of Open Field/Waste Disposal Areas

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Rental home lead-contaminated area	**1,350**	BCY	1,688	LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.

Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.

Assume soils will be transported directly to the pugmilling and stabilization operation then to a staging area for one week incubation time.

Total excavation in Rental Home area 2.3 days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Subtotal for Excavation and Handling of Contamimated Soil in Rental Home area **$21,290**

B) Post Excavation Sampling

Assume one sample per 900 square feet.

Total Excavation Surface Area in Rental Home area 18,121 SF

Number of samples for TAL metal analysis for Rental Home area 21

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	21	EA	$ 120	$ 2,520
Sampling planning and Sample collection cost	21	EA	$ 200	$ 4,200
Sample reporting	1	LS	$ 5,000	$ 5,000

Subtotal for PostExcavation Sampling **$ 11,720**

C) - Transportation and Disposal

Assumes only 30% of the excavated soils will be hazardous.

Transportation and Disposal Costs

a) Quantity calculation based on existing data

b) Add 25% additional volume to account for bulking between bank and loose cubic yards for soil.

c) Assumes 1.6 tons per CY for soil

d) Assumes debris to be less than 3"x3"x3"

e) Assumes Subtitle C landfill would be in Ohio (Envirosafe) and Subtitle D landfill would be in Pennsylvania (Progressive Waste Solutions).

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Lead-contaminated soils (hazardous)	405	506	700	$295	$206,500
Lead-contaminated soils (nonhazardous)	945	1,181	1,600	$110	$176,000
Total	**1,350**	**1,688**	**2,300**		**$382,500**

Subtotal Transportation and Disposal Cost **$382,500**

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	PROJECT: Matteo		COMPUTED BY : KK		CHECKED BY: GC
	JOB NO.: 101995.3323.032		DATE : 6/17/2019		DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT: EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

Labor and equipment costs for loading the truck for offsite disposal					
Assume 25 truck (22 tons) per day for offsite shipment					
Time for loading the material for offsite disposal				4 days	
Excavator, Hydraulic, 2 CY		$1,800 per day			
Equip. Op. Heavy		$800 per day			
Laborer (Semi-Skilled)		$612 per day			
Laborer (Semi-Skilled)		$612 per day			
Total rate per day		$3,824 per day			
Subtotal Labor Cost		**$15,296**			
Total Transportion and Disposal Costs			**$398,000**		
D) Rental Home Area Restoration					
Assume backfill will be to grade.					
Material Costs					
Surface area of soils to be replaced		10,000 SF			
Surface area of gravel to be replaced		8,121 SF			
Common fill	1,276	LCY	$21	=	$26,796
Gravel	180	CY	$30	=	$5,414
Top soil and hydroseed	231	LCY	$40	=	$9,259
Subtotal Material Costs				$ 41,469	
Labor Costs					
Backfill and Compaction Labor/Equipment Costs					
Assume same labor/equipment costs as OFWD area backfill.					
Duration of Backfill			3 day		
Total Equipment and Labor for Backfill and Compaction				$29,230	
Topsoil Tilling Labor/Equipment Costs					
Assume topsoil will be tilled to six inches.					
Assume production rate of 270,000 square feet.					
Loader-Backhoe			$300 per day		
Equip. Op. Light			$590 per day		
Topsoil Tilling Crew Unit Cost			$890 per day		
Duration of soil cover tilling			1 day		
Total Equipment and Labor for Topsoil Tilling				$890	
Assume hydroseeding of lawn mix.					
Assume production rate of 44,000 square feet.					
Laborer			$464 per day		
Equip. Op. Medium			$620 per day		
Truck Dr. heavy			$1,500 per day		
Hydromulcher (3000 gal)			$400 per day		
Truck Tractor (200 H.P)			$450 per day		
Hydroseeding Crew Unit Cost			$3,434 per day		
Duration of hydroseeding			1 days		
Total Equipment and Labor				$3,434	
Subtotal Labor Costs				$ 33,554	
Subtotal for Restoration for Rental Home area					**$76,000**
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION IN RENTAL HOME AREA					**$508,000**

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PROJECT: Matteo	COMPUTED BY : KK	CHECKED BY: GC
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CLIENT: EPA		

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

13 - Mira Trucking Remediation

A) Excavation of Mira Trucking

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place	excavated
Lead-contaminated area	**11,200** BCY	14,000 LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.
Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.
Assume soils will be transported to the containment cell area.

Excavation duration — 19 days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000 per day
Equip. Op. Heavy	$800 per day
Dump Truck (2)	$1,469 per day
Truck Dr. medium (2)	$1,212 per day
Bull dozer	$1,751 per day
Equip. Op. Heavy	$800 per day
Laborer (Semi-Skilled)	$612 per day
Laborer (Semi-Skilled)	$612 per day
Excavation and Waste Segregation Crew Unit Cost	$9,256 per day

Subtotal for Excavation and Handling of Contamimated Soil in Mira Trucking — **$173,094**

B) Post Excavation Sampling — $0

Assume one sample per 900 square feet.

Total Excavation Surface Area — 151,549 SF

Number of samples for TAL metal analysis — 169

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	169	EA	$ 120	$ 20,280
Sampling planning and Sample collection cost	169	EA	$ 200	$ 33,800
Sample reporting	1	LS	$ 5,000	$ 5,000

Subtotal for Post Excavation Sampling — **$ 59,080**

C) Offsite transportation and disposal

Transportation and disposal costs

a) Quantity calculation based on data from the RST3 report.
b) Assumes 25% additional volume to account for bulking between bank and loose cubic yards of soil.
c) Assumes 1.6 tons per CY for the materials.
d) Assumes debris to be less than 3'x3'x3'
e) Assumes Subtitle C landfill would be in Ohio (Envirosafe).

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Lead-contaminated soils	11,200	14,000	18,000	$295	$5,310,000
Total					**$5,310,000**

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY: GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA			

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

13 - Mira Trucking Remediation

Labor and equipment costs for loading the truck for offsite disposal						
Assume 25 trucks (22 tons) working per day for offsite shipment.						
Time for loading the material for offsite disposal					26 days	
Excavator, Hydraulic, 2 CY		$1,800 per day				
Equip. Op. Heavy		$800 per day				
Laborer (Semi-Skilled)		$612 per day				
Laborer (Semi-Skilled)		$612 per day				
Total rate per day		$3,824 per day				
Subtotal for labor and equipment		**$99,424**				
Total for transportation and disposal for Mira Trucking						**$5,409,424**
D) Mira Trucking Restoration						
Assume backfill including common fill and 6-inches of gravel will be to grade.						
Material Costs						
Surface area of soils to be replaced		151,549 SF				
Common fill	11,193	LCY	$21	=		$235,053
Gravel	2,807	CY	$30	=		$84,210
Subtotal Material Costs				$ 319,263		
Labor Costs						
Backfill and Compaction Labor/Equipment Costs						
Assume same labor/equipment costs as OFWD area backfill.						
Duration of Backfill			24 day			
Total Equipment and Labor for Backfill and Compaction				$ 233,840		
Subtotal for Restoration at Mira Trucking						**$554,000**
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION AT MIRA TRUCKING						**$6,196,000**

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	PROJECT: Matteo	COMPUTED BY : KK	CHECKED BY: GC
	JOB NO.: 101995.3323.032	DATE : 6/17/2019	DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT: EPA		

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

14 - Inspection and Maintenance							
A) Inspection of Cover							
Assume annual inspection of soil cover for a default period of 30 years							
Annual allowance for inspection and an annual report							$10,000
B) Maintenance of Asphalt Cover							
Assume 3% cap and backfill costs for maintenance every year for a default period of 30 years							
Annual average allowance for soil cover maintenance							$24,930
Total Annual Costs for Inspection and Maintenance							**$34,930**
15 - Long-term Groundwater Monitoring							
Number of monitoring points			20	monitoring points			
Number of samplers			3	samplers			
Number of 10-hour workdays			5	days			
Sampling Project Planning							
Project Manager	4	hr	$150	=	$	600	
Engineer	8	hr	$110	=	$	880	
Scientist	8	hr	$100	=	$	800	
Procurement	5	hour	$90	=	$	450	
Field Sampling							
Field Tech 1	100	hour	$85	=	$	8,500	
Geologist	50	hour	$110	=	$	5,500	
Per diem	15	day	$181	=	$	2,715	
Car rental	12	day	$95	=	$	1,140	
Equipment & PPE	5	day	$300	=	$	1,500	
Shipping	5	day	$300	=	$	1,500	
Misc	5	day	$100	=	$	500	
Sampling Analysis (includes QC samples)							
VOCs	24	ea	$150	=	$	3,600	
TAL Metals	24	ea	$250	=	$	6,000	
Reporting							
Project manager	8	hour	$150	=	$	1,200	
Scientist	24	hour	$100	=	$	2,400	
QA/QC	4	hour	$110	=	$	440	
Data validation	24	hr	$150	=	$	3,600	
Tabulate the data and prepa	1	LS	$3,000	=	$	3,000	
Prepare the data report	1	LS	$5,000	=	$	5,000	
Clerk	8	hour	$75	=	$	600	
Total Annual Costs for Long-term Monitoring				=			**$49,925**

Appendix E-3
Cost Estimate for Alternative 4 - Excavation, Offsite Disposal of Source Materials and Contaminated Soils, and Capping

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				

Description: FS Cost Estimate for Alternative 4 - Individual Cost Item Backup

Present Worth Calculation for Inspection and Maintenance, and Long-term Monitoring Costs

This is a recurring cost every year.		
This discount factor is (P/A,i,n)		
P = Present Worth		
A = Annual amount		
i = interest rate	7%	
n = number of years	30	
n = number of years	10	

$$P = A \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

The multiplier for (P/A) for 30 years =	**12.4**	
The multiplier for (P/A) for 10 years =	**7.0**	
TOTAL INSPECTION AND MAINTENANCE COST:		**$434,000**
TOTAL MONITORING COST:		**$351,000**

Appendix E-4
Cost Estimate for Alternative 5
Excavation and Offsite Disposal
Matteo & Sons, Inc. Site
Thorofare, NJ

No.	Description	Cost
	Remedial Action	
01	General requirements	$3,757,000
02	Site Work	$708,000
03	Excavation/Dredging and Handling of Sediment and Battery Casing Waste	$3,104,000
04	Excavation of Contaminated Soils at Open Field/Waste Disposal Areas and at Scrapy	$889,000
05	Transportation and Disposal	$40,450,000
06	Post-Excavation sampling	$404,000
07	Shoreline restoration	$882,000
08	Open Field/Waste Disposal Area Restoration	$1,025,000
09	Scrapyard Area Restoration	$1,101,000
10	Connections to Public Water	$61,000
11	Overall site restoration	$100,000
12	Rental Home Area Remediation	$508,000
13	Mira Trucking Remediation	$6,196,000
	Subtotal	*$59,185,000*
	Contingency (20%)	$11,837,000
	Subtotal	*$71,022,000*
	General Contractor Bond and Insurance (5%)	$3,552,000
	Subtotal	*$74,574,000*
	General Contractor Markup (profit - 10%)	$7,458,000
	Subtotal of Remedial Action	**$82,032,000**
	MONITORING	
14	Annual Groundwater Monitoring	$50,000
	Present Worth for Long-Term Monitoring (10 Years)	$351,000
	PRESENT WORTH	
	Total Capital Cost	**$82,032,000**
	Total O&M Cost	**$351,000**
	Total Present Worth	**$82,383,000**

Note: The project cost presented herein represents only feasibility study level, and is thus subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate. Expected accuracy range of the cost estimate is -30% to +50%.

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	**PROJECT:** Matteo		**COMPUTED BY :** KK		**CHECKED BY:** GC	
	JOB NO.: 101995.3323.032		**DATE :** 6/17/2019		**DATE CHECKED:** 6/17/2019	
CDM Federal Programs Corporation	**CLIENT:** EPA					
Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup						
01 - General Requirements						
Project Schedule						
Assume the following construction schedule:						
Pre-construction work plans and meetings			4	months		
Field mobilization (permits and trailer compound establishment)			1	months		
Site preparation (clearing and grubbing and stockpile areas)			1	months		
Berm construction			3	months		
Excavation/dredging of source materials with dewatering			10	months		
Excavation in open field waste disposal area and rental home area			2	months		
Other lead contaminated soils						
PCB-contaminated soils						
Rental Home area soils						
Excavation of lead- and PCB-contaminated soils in scrapyard			2	months		
Shoreline (wetland) restoration			3	months		
Backfill in Open Field/Waste Disposal area			3	months		
Backfill in Scrapyard area			2	months		
Final site restoration and demobilization			1	months		
Total Construction Duration			**28**	**months**	**122**	**weeks**
Project closeout			4	months		
Total Project Duration			**36**	**months**	**156**	**weeks**
General Conditions						
A) Project Management and Site Supervisory						
Assume the following Staff for 20 hours per week for the duration of project:						
Project Manager		$150	per hour			
Project Engineer		$110	per hour			
Procurement staff (20 hours per week)		$90	per hour			
Total management and office support				$1,093,952		
B) Work Plan Preparation						
Estimated # of Pre-Construction Work Plans Required:			10 work plans			
Estimated # of Engineer Hours Required per Work Plan:			120 hours			
Project Engineer		$110	per hour			
Project Manager (half time)		$150	per hour			
Total Work Plan Preparation Cost:				$222,000		
C) Permits						
Permit Specialist	250	hr	$125	=	$31,250	
Project Manager	120	hr	$150	=	$18,000	
Total Work Plan Preparation Cost:					$49,250	
D) Onsite supervisory						
Assume the following full time site supervisory staff for the duration of construction:						
Site Superintendent		$120	per hour			
Construction Foreman		$100	per hour			
Environmental Technician (QC)		$85	per hour			
Pickup Truck #1		$100	per day			
Pickup Truck #2		$100	per day			
per diem for superintendant		$123	per day			
Hourly total		$345	per hour			
		$13,815	per week			
Total Onsite Supervisory Staff for Construction Duration				$1,681,000		
Subtotal General Conditions:				**$3,047,000**		

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC	
CDM Federal Programs Corporation	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED:	6/17/2019	
	CLIENT:	EPA					

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

01 - General Requirements

Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer (SHSO), personnel protective equipment and supplies, and additional safety and air monitoring equipment/testing.

Assume PPE required for 20 people per work da for the duration of construction activities.

Total Construction Duration:		122	weeks		
SHSO	1220	hr	$125	=	$152,500
PPE	610	day	$10	=	$122,000
Additional Safety and Air Monitoring Equipment			10%	=	$12,200
					$286,700

Temporary Facilities

Temporary Facilities to include the field trailers, utilities, cleaning services, and office equipment and supplies.

Assume four project trailers required (2 for Contractor, 1 for EPA, and 1 shower trailer)

Trailer rental (4 trailers)	28	month	$500	=	$56,129
Electricity	28	month	$200	=	$22,451
Electricity hookup	1	LS	$10,000	=	$10,000
Phone/Internet	28	month	$80	=	$2,245
Water/Sewer	28	month	$60	=	$1,684
Cleaning service and others	28	month	$300	=	$8,419
					$100,928

Security

Assume for duration of construction requires 16-hour security guard for weekdays and 24-hour security guard for weekends.

Total Field Duration:		122 weeks			
Security trailer rental	28	month	$150	=	$4,210
Security guard	122	week	$2,600	=	$317,200
					$321,410

TOTAL COST FOR GENERAL REQUIREMENTS	**$3,757,000**

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY:	GC
	JOB NO.:	101995.3323.032	DATE :	4/19/2019	DATE CHECKED:	6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

02 - Site Work

Clearing and Grubbing

Assume clearing and grubbing the battery casing waste areas and the open field/waste disposal areas.
Assume staging area will be in the open field/waste disposal area.

Battery Casing Area		245,000 SF			
Open Field/Waste Disposal Area		397,320 SF			
Total		642,320 SF			15 acres
Clearing and grubbing	15	acre	$6,000	=	**$90,000**

Mobilization of Construction Equipment

Field mobilization (allowance)	1	LS	$50,000	=	**$50,000**

Construction of Sediment Dewatering Cell

Assume 10 days storage at 300 CY per day, and sediment stores at 2 feet thick.
Assume dewatering cell will be lain with 60 mil thick HDPE liner, with 6 inches of sand and then 6 inches of gravel on top.

Materials

	Area		Unit price	Extended costs
HDPE Liner	40,500	SF	$0.50	$20,250
6 inches of gravel	750	CY	$35.00	$26,250
6 inches of sand	750	CY	$30.00	$22,500
Subtotal				$69,000

Assume 10 days for completion.

Labor

Skilled Workers (3)	$1,440	per day
Loader, 1 1/2 CY	$1,119	per day
Equip. Op. Heavy	$800	per day
Duration	10	days
Subtotal	$33,587	

Subtotal of construction of sediment dewatering cell	**$102,587**

Surveying

Survey would be conducted both prior to and after excavation and after site restoration
Surveyor onsite during excavation and backfill period (for depth verification, quantity measurement, waste char. samples, final grading)

Total Surveying Duration: 100 weeks

Professional Surveyor	40	hr	$120	=	$4,800
Surveyor	1000	hr	$75	=	$75,025
Assistant surveyor	1000	hr	$65	=	$65,021
Submittals	1	LS	$20,000	=	$20,000
Subtotal for surveying					**$164,846**

Erosion Control

Total Construction Duration:	122 weeks
Length of Erosion Measure	
Along source materials	3500 LF
Along the contaminated open field/waste areas	5500 LF
Along scrapyard areas	2100 LF
Total length	11100 LF

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
	JOB NO.:	101995.3323.032	**DATE :**	4/19/2019	**DATE CHECKED:**	6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA				
Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup						
02 - Site Work						
Assume daily output of silt fencing at 1,300 LF and hay bales at 2,500 LF.						
Erosion control measure Installatio	104	hr	$100	=	$10,383	
Silt fence	11100	LF	$1.82	=	$20,202	
Hay bale	11100	LF	$13.65	=	$151,515	
Maintenance	122	week	$500	=	$60,806	
Subtotal for erosion controls					**$242,906**	
Decontamination						
Assume decontamination pad required during construction duration only.						
Duration for Excavation and Consolidation			40 weeks			
Construction of Decon Pad	1	LS	$10,000	=	$10,000	
Decontamination operation						
Assume 2 workers for 2 hours per day to perform equipment decontamination on-site including T&D trucks.						
Laborer	405	hr	$58	=	$23,471	
Laborer	405	hr	$58	=	$23,471	
Subtotal for decontamination					**$56,941**	
Total for Site Works					**$708,000**	

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY: GC
	JOB NO.:	101995.3323.032	DATE :	4/19/2019	DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA			

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

03 - Excavation and Handling of Sediment and Battery Casing Containing Waste

Assume an earth berm will be built to block the tidal water

Construction of Earth Embankment - Berm

A) Soil volume for construction of an earth embankment along outer boundary of sediment excavation area

Length			3,000 ft			
Height			7 ft			
Top width			10 ft			
Bottom width (1:2 side slope)			38 ft			
In place volume			18,667 BCY			
Common fill volume (25% swell factor)			23,334 LCY			
Common fill cost	23,334	LCY	$21	=	$491,000	

B) Impermeable layer to prevent contamination of earth embankment

Length		3,000 ft			
Sloping height		16 ft			
Total area		46,957 SF			
Impermeable layer	46,957 SF	$1.84	=	$87,000	

C) Equipment & Labor Costs

Assume 400 CY/day production rate for berm construction

Total berm construction	=	58 days		12 weeks
				3 months
Equipment and Crew				
Loader, 1 1/2 CY		$1,119 per day		
Equip. Op. Heavy		$800 per day		
Dump Truck (2)		$1,469 per day		
Truck Dr. medium (2)		$1,212 per day		
Bull dozer		$1,751 per day		
Equip. Op. Heavy		$800 per day		
Compaction Roller		$568 per day		
Equip. Op. Heavy		$800 per day		
Laborer (Semi-Skilled)		$612 per day		
Laborer (Semi-Skilled)		$612 per day		
Excavation Crew Unit Cost		$9,743 per day		
Equipment and Labor			$569,000	
Subtotal berm construction cost			**$1,147,000**	

Excavation of Sediment, Battery Casings, and Waste

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

Assume cutbacks are not needed because excavations are shallow and those deeper are sloping due to the dumping of the battery casings on top of natural slope.

	in-place	excavated
Sediment	8,600 BCY	10,750 LCY
Battery casings	38,500 BCY	48,125 LCY
1 foot soil beneath battery casings	9,100 BCY	11,375 LCY

CDM Smith	**PROJECT:**	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:** GC
	JOB NO.:	101995.3323.032	**DATE :**	4/19/2019	**DATE CHECKED:** 6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

03 - Excavation and Handling of Sediment and Battery Casing Containing Waste

B) Production rates			
Production rate for excavation of sediment and battery casings with waste segregation			300 CY/day
Assume excavation is performed concurrently with segregation.			
Assuming sediment will be air dried for three weeks before pubmilling and stabilization then to a staging area for one week incubation period.			
Assume battery casings will be transported to the pugmilling/stabilization operation and then to a staging area for a one week incubation period.			
Total excavation			187 days
Total dewatering for sediments			15 days
Total excavation and dewatering period, work weeks			40 weeks
Total excavation and dewatering period, work months			10 months
C) Excavation Labor/Equipment Costs			
Excavating and segregation Crew			
Excavator, Hydraulic, 2 1/2 CY	$2,000 per day		
Equip. Op. Heavy	$800 per day		
Dump Truck (2)	$1,469 per day		
Truck Dr. medium (2)	$1,212 per day		
Bull dozer	$1,751 per day		
Equip. Op. Heavy	$800 per day		
Laborer (Semi-Skilled)	$612 per day		
Laborer (Semi-Skilled)	$612 per day		
Excavation and Waste Segregation Crew Unit Cost	$9,256 per day		
Subtotal excavation cost		**$1,873,000**	
D) Maintenance of dewatering cell for sediment			
Duration:	44 days		
Loader, 1 1/2 CY	$1,119 per day		
Equip. Op. Heavy	$800 per day		
	$1,919 per day		
Subtotal dewatering operation cost		**$84,000**	
Total for Excavation and Handling of Sediment, Battery Casings, and Battery Casing Mixed Waste			**$3,104,000**

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK		**CHECKED BY:** GC	
	JOB NO.: 101995.3323.032	**DATE :** 4/19/2019		**DATE CHECKED:** 6/17/2019	
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

04 - Excavation of Contaminated Soils at Open Field/Waste Disposal Areas and at Scrapyard

Assume lead-contaminated soils in open field/waste disposal area also include lead-contaminated soils with PCB contamination

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)				
Assume 25% volume increase of after excavation				
Assume cutbacks are needed for excavations deeper than four feet.				
	in-place		excavated	
Open Field/Waste Disposal Lead-contaminated soils	**7,100**	BCY	8,875	LCY
Open Field/Waste Disposal PCB-contaminated (only) soils	**6,900**	BCY	8,625	LCY
Open Field/Waste Disposal Soils with lead above Eco PRG	**9,200**	**BCY**	11,500	LCY
Cut back for OFWD excavations (lead)	100	BCY	125	LCY
Cut back for OFWD excavations (PCBs)	200	BCY	250	LCY
Scrapyard Lead-contaminated Soils	**12,400**	BCY	15,500	LCY
Scrapyard PCB-contaminated (only) Soils	**2,400**	BCY	3,000	LCY
B) Production rates				
Assume 400 CY/day production rate for excavation of soils with waste segregation.				
Assume excavation is performed concurrently with source material excavation.				
Total excavation			96	days
Total excavation period, work weeks			19	weeks
Total excavation period, work months			5	months
C) Excavation Labor/Equipment Costs				
Excavating and segregation Crew				
Excavator, Hydraulic, 2 1/2 CY	$2,000	per day		
Equip. Op. Heavy	$800	per day		
Dump Truck (2)	$1,469	per day		
Truck Dr. medium (2)	$1,212	per day		
Bull dozer	$1,751	per day		
Equip. Op. Heavy	$800	per day		
Laborer (Semi-Skilled)	$612	per day		
Laborer (Semi-Skilled)	$612	per day		
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day		
Total for Excavation and Handling of Contamimated Soil in OFWD			**$889,000**	

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	PROJECT: Matteo	MPUTED BY : KK	CHECKED BY: GC
	JOB NO.: 101995.3323.032	DATE : 4/19/2019	ATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT: EPA		

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

05 - Transportation and Disposal

A) Transportation and Disposal Costs

a) Quantity calculation based on existing data
b) Add 25% additional volume to account for bulking between bank and loose cubic yards for soil. For battery casings and waste, assume 0% bulking factor
c) Assumes 1.6 tons per CY for soil and waste pile debris
d) Assumes debris to be less than 3'x3'x3'
e) Assumes Subtitle C landfill would be in Ohio (Envirosafe) and Subtitle D landfill would be in Pennsylvania (Progressive Waste Solutions).
F) Assume 7% of PCB-contaminated OFWD soils is above 50 mg/kg.

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Source materials - battery casings	38,500	38,500	61,600	$295	$18,172,000
Source materials - sediment	8,600	10,750	13,800	$295	$4,071,000
Soil beneath battery casings	9,100	11,375	14,600	$295	$4,307,000
Lead-contaminated OFWD Soils	7,100	8,875	11,400	$295	$3,363,000
OFWD Soils with lead above Eco PRG	9,200	11,500	14,800	$110	$1,628,000
Cutback soils	300	375	500	$110	$55,000
PCB-contaminated OFWD Soils (below 50mg	6,417	8,021	10,300	$110	$1,133,000
PCB-contaminated OFWD Soils (above 50mg	483	604	800	$295	$236,000
Lead-contaminated Scrapyard soils	12,400	15,500	19,900	$295	$5,870,500
PCB-contaminated Scrapyard soils	2,400	3,000	3,900	$110	$429,000
Total	**94,500**	**108,500**			**$39,264,500**

Total Transportation and Disposal Cost **$39,264,500**

B) Labor and equipment costs for loading the truck for offsite disposal

Assume 25 trucks (22 tons each) per day for offsite shipment

Time for loading the material for offsite disposal		310 days
Excavator, Hydraulic, 2 CY	$1,800 per day	
Equip. Op. Heavy	$800 per day	
Laborer (Semi-Skilled)	$612 per day	
Laborer (Semi-Skilled)	$612 per day	
Total rate per day	$3,824 per day	

Total Cost **$1,185,440**

Total Transportion and Disposal Costs **$40,450,000**

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY: GC
	JOB NO.:	101995.3323.032	DATE :	4/19/2019	DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA			

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

06 - Post Excavation Sampling

Assume one sample per 900 square feet.					
Surface area of battery casings		245,000	SF		
Surface area of sediment		155,820	SF		
Surface area of lead-contaminated soils in OFWD		74,863	SF		
Surface area of PCB-contaminated soils (only) in OFWD		165,485	SF		
Surface area of soils with lead above eco PRGs in OFWD		156,972	SF		
Surface area of lead-contaminated and PCB-contaminated soils in Scrapyard		223,000	SF		
Total Excavation Surface Area		1,021,140	SF		
Number of samples for TAL metal analysis		1135			
	Quantity	Unit		Unit cost	Extended Cost
Analytical cost	1135	EA		$ 120	$ 136,200
Sampling planning and Sample collection cost	1135	EA		$ 200	$ 227,000
Sample reporting	1	LS		$ 40,000	$ 40,000
TOTAL for POST EXCAVATION SAMPLING					**$ 404,000**

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 4/19/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

07 - Shoreline Restoration

A) Backfill volume and material costs for sediment

Assume backfill will restore shoreline to pre-impacted grades before dumping of battery casings and waste.
Assume backfill one foot of the excavated area then a 1:2 slope for the shoreline with an assumed 7 feet vertical height of the shore line.
Assume backfill will use the imported fill brought in for berm construction.

Areal extent of sediment to be excavated					155,900	SF
Areal extent of battery casings and mixed waste					245,000	SF
Shoreline length after excavation of battery casing and mixed waste					3,000	LF
Volume for shoreline slope					5,444	BCY
Assume 1 foot of clean material backfilled					400,900	CF
Subtotal backfill volume for excavated area					14,850	BCY
Total backfill volume for shoreline				20,294 BCY		
				25,370 LCY		
Volume from earth berm				18,667 BCY		
Therefore, additional common fill needs to be purchased for shoreline restoration.						
Extra common fill needed	1,627	BCY				
Common fill	2,034	LCY	$21	=	$42,720	
Subtotal for Backfill					**$42,720**	

B) Backfill Labor/Equipment Costs

Assume 300 CY/day production rate for backfill, no compaction needed.

Total shoreline backfill duration	=	85	days
		17	weeks
		3	months
Long reach excavator		$1,751	per day
Equip. Op. Heavy		$800	per day
Dump Truck (2)		$1,469	per day
Truck Dr. medium (2)		$1,212	per day
Long reach excavator		$1,751	per day
Equip. Op. Heavy		$800	per day
Laborer (Semi-Skilled)		$612	per day
Laborer (Semi-Skilled)		$612	per day
Shoreline Backfill Crew Unit Cost		$9,008	per day
Equipment and Labor			**$762,000**

C) Shoreline erosion control costs

Assume the area of shoreline slope need to be seeded and maintained				46,957	SF
Materials					
Geofabric	26840	SF	1.84	$49,400	
Shoreline length	3,000	feet			
length of sloping excavation	9	feet			
Installation of wetland seed				$10,000	
One year of maintenance				$17,000	
Subtotal				**$76,400**	
Total for Shoreline Restoration					**$882,000**

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

08 - Open Field/Waste Disposal Area Restoration

Assume restoration will entail backfill of one foot of common fill and half a foot of topsoil in the OFWD areas with rough grading.

Material Costs					
Excavated surface area	397,320 SF				
Common fill required for excavation	14,800	CY	$21	=	$310,800
Top soil	7,358	CY	$40	=	$294,320
Total Material Costs	22158				**$ 605,120**
Labor Costs					
Backfill and Compaction Labor/Equipment Costs					
Assume transport of material is included with excavation.					
Assume production rate of 600 BCY per day.					
Assume side sloping volume is negligible as the treated material layer will not be over three feet.					
Loader, 1 1/2 CY			$1,119	per day	
Equip. Op. Heavy			$800	per day	
Dump Truck (2)			$1,469	per day	
Truck Dr. medium (2)			$1,212	per day	
Bull dozer			$1,751	per day	
Equip. Op. Heavy			$800	per day	
Compaction Roller			$568	per day	
Equip. Op. Heavy			$800	per day	
Laborer (Semi-Skilled)			$612	per day	
Laborer (Semi-Skilled)			$612	per day	
Backfill Crew Unit Cost			$9,743	per day	
Duration of Backfill			37	days	
Total Backfill and compaction					**$359,820**
Rough Grading Labor/Equipment Costs					
Assume transport of material is included with excavation.					
Assume production rate of 600 BCY per day.					
Assume side sloping volume is negligible as the treated material layer will not be over three feet.					
Equip. Op. Medium			$620	per day	
Laborer			$464	per day	
Grader (30,000 lbs)			$786	per day	
Grading Crew Unit Cost			$1,870	per day	
Duration of Rough Grading			6	days	
Total Rough Grading					**$11,220**
Hydroseed and erosion controls					
Open field waste disposal area	400,000	SF	$0.08	=	$32,000
Other erosion control allowrance					$16,000
Total hydroseeding					**$48,000**
TOTAL FOR ROUGH GRADING IN OPEN FIELD/WASTE DISPOSAL AREA				**$1,025,000**	

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC		
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019		
CDM Federal Programs Corporation	**CLIENT:** EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

09 - Scrapyard Area Restoration

Material Costs						
Surface area of soils to be replaced		181,657 SF				
Common fill	14,295	LCY	$21	=	$300,195	
Top soil and hydroseed	4,205	LCY	$40	=	$168,201	
Total Backfill Material Costs					**$468,400**	
Replace asphalt driveway						
Surface area of asphalt to be replaced			93,000	SF		
Assume 6 inch crushed stone aggregate base, 2 inch binder course, and 2 inch of wearing course.						
Wearing Course	93,000 SF		$2.50	=	$232,500	
Binder Course	93,000 SF		$2.50	=	$232,500	
Base Course (aggregate)	1,730 CY		$15.00	=	$25,950	
Total Cost for Materials				=	**$490,950**	
Subtotal Materials Costs						**$ 959,350**
Labor Costs						
Backfill and Compaction Labor/Equipment Costs						
Assume same labor/equipment costs as OFWD area.						
Duration of Backfill			31 days			
Total Equipment and Labor for Backfill and Compaction				$57,660		
Topsoil Tilling Labor/Equipment Costs						
Assume topsoil will be tilled to six inches.						
Assume production rate of 270,000 square feet.						
Loader-Backhoe			$300 per day			
Equip. Op. Light			$590 per day			
Topsoil Tilling Crew Unit Cost			$890 per day			
Duration of soil cover tilling and hydroseeding			1 day			
Total Equipment and Labor for Topsoil Tilling				$890		
Assume hydroseeding of slope mix, with mulch and fertilizer.						
Assume production rate of 300 square feet.						
Laborer			$464 per day			
Equip. Op. Medium			$620 per day			
Truck Dr. heavy			$1,500 per day			
Hydromulcher (3000 gal)			$400 per day			
Truck Tractor (200 H.P)			$450 per day			
Hydroseeding Crew Unit Cost			$3,434 per day			
Duration of hydroseeding			1 day			
Total Equipment and Labor				$3,434		
Asphalt Labor/Equipment Costs						
Assume crew daily output of 9,000 SF.						
Labor Foreman			$2,000 per day			
Laborers (3)			$1,390 per day			
Equip. Op. Medium (2)			$1,228 per day			
Asphalt Paver			$2,345 per day			
Tandem Roller			$260 per day			
Excavation and Waste Segregation Crew Unit Cost			$7,223 per day			
Duration for Asphalt construction			11 days			
Total Equipment and Labor for Asphalt Pavement				$79,453		
Subtotal Labor Costs						**$ 141,437**
TOTAL FOR BACKFILL AND RESTORATION IN SCRAPYARD AREA				**$1,101,000**		

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019
CDM Federal Programs Corporation	**CLIENT:** EPA		

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

10 - Connections to Public Water

Assume 3 hook ups to city water including the residence, the Matteo facility, and the tire shop.

Trenching and piping

Assume 350 ft pipe from Residential Home to water connection for Willow Woods
Assume 720 ft pipe from the Matteo facility to water connection for Willow Woods
Assume 475 ft from the tire shop to the water connection for Willow Woods
Assume trenching production rate of 135 CY per day, backfill production rate of 400 LCY per day, and piping rate of 39 LF per day.
Assume trench is 2 feet wide and 3 feet deep.

Materials			
Piping from Residence to water connection	350	ft	
Piping from Matteo facility to water connection	720	ft	
Piping from the tire shop to water connection	475	ft	
4-inch HDPE piping	$2.25	LF	
Subtotal	$3,477		
Volume of soil to be trenched	350	BCY	
Volume of backfill required	393	LCY	
Labor and Equipment			
Equip. Op. Medium	$614	per day	
Laborer	$463	per day	
Backhoe Loader	$400	per day	
Trenching and Backfill Crew Unit Cost	$1,477	per day	
Plumber	$710	per day	
Plumber apprentice	$570	per day	
Piping Crew Unit Cost	$1,280	per day	
Duration of Trenching and Backfill work	4	days	
Duration of Piping work	40	days	
Subtotal	$57,110		
Total for Water Connections			**$61,000**

CDM Smith

	PROJECT:	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:** GC
	JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:** 6/17/2019
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

12 - Rental Home Area Remediation

Assume lead-contaminated soils in open field/waste disposal area also include lead-contaminated soils with PCB contamination

A) Excavation of Open Field/Waste Disposal Areas

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Rental home lead-contaminated area	**1,350**	BCY	1,688	LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.

Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.

Assume soils will be transported directly to the pugmilling and stabilization operation then to a staging area for one week incubation time.

Total excavation in Rental Home area — 2.3 days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Subtotal for Excavation and Handling of Contamimated Soil in Rental Home area — **$21,290**

B) Post Excavation Sampling

Assume one sample per 900 square feet.

Total Excavation Surface Area in Rental Home area — 18,121 SF

Number of samples for TAL metal analysis for Rental Home area — 21

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	21	EA	$ 120	$ 2,520
Sampling planning and Sample collection cost	21	EA	$ 200	$ 4,200
Sample reporting	1	LS	$ 5,000	$ 5,000

Subtotal for PostExcavation Sampling — **$ 11,720**

C) - Transportation and Disposal

Assumes only 30% of the excavated soils will be hazardous.

Transportation and Disposal Costs

a) Quantity calculation based on existing data

b) Add 25% additional volume to account for bulking between bank and loose cubic yards for soil.

c) Assumes 1.6 tons per CY for soil

d) Assumes debris to be less than 3"x3"x3"

e) Assumes Subtitle C landfill would be in Ohio (Envirosafe) and Subtitle D landfill would be in Pennsylvania (Progressive Waste Solutions).

CDM Smith
CDM Federal Programs Corporation

PROJECT: Matteo	**COMPUTED BY :** KK	**CHECKED BY:** GC
JOB NO.: 101995.3323.032	**DATE :** 6/17/2019	**DATE CHECKED:** 6/17/2019
CLIENT: EPA		

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Lead-contaminated soils (hazardous)	405	506	700	$295	$206,500
Lead-contaminated soils (nonhazardous)	945	1,181	1,600	$110	$176,000
Total	**1,350**	**1,688**	**2,300**		**$382,500**

Subtotal Transportation and Disposal Cost **$382,500**

Labor and equipment costs for loading the truck for offsite disposal

Assume 25 truck (22 tons) per day for offsite shipment

Time for loading the material for offsite disposal		4 days
Excavator, Hydraulic, 2 CY	$1,800	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Total rate per day	$3,824	per day

Subtotal Labor Cost **$15,296**

Total Transportion and Disposal Costs **$398,000**

D) Rental Home Area Restoration

Assume backfill will be to grade.

Material Costs

Surface area of soils to be replaced	10,000	SF			
Surface area of gravel to be replaced	8,121	SF			
Common fill	1,276	LCY	$21	=	$26,796
Gravel	180	CY	$30	=	$5,414
Top soil and hydroseed	231	LCY	$40	=	$9,259

Subtotal Material Costs **$ 41,469**

Labor Costs

Backfill and Compaction Labor/Equipment Costs

Assume same labor/equipment costs as OFWD area backfill.

Duration of Backfill	3	day
Total Equipment and Labor for Backfill and Compaction		$29,230

Topsoil Tilling Labor/Equipment Costs

Assume topsoil will be tilled to six inches.

Assume production rate of 270,000 square feet.

Loader-Backhoe	$300	per day
Equip. Op. Light	$590	per day
Topsoil Tilling Crew Unit Cost	$890	per day
Duration of soil cover tilling	1	day
Total Equipment and Labor for Topsoil Tilling		$890

CDM Smith	**PROJECT:** Matteo	**COMPUTED BY :** KK		**CHECKED BY:** GC	
	JOB NO.: 101995.3323.032	**DATE :** 6/17/2019		**DATE CHECKED:** 6/17/2019	
CDM Federal Programs Corporation	**CLIENT:** EPA				
Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup					
Assume hydroseeding of lawn mix.					
Assume production rate of 44,000 square feet.					
Laborer		$464	per day		
Equip. Op. Medium		$620	per day		
Truck Dr. heavy		$1,500	per day		
Hydromulcher (3000 gal)		$400	per day		
Truck Tractor (200 H.P)		$450	per day		
Hydroseeding Crew Unit Cost		$3,434	per day		
Duration of hydroseeding		1	days		
Total Equipment and Labor			$3,434		
Subtotal Labor Costs			$ 33,554		
Subtotal for Restoration for Rental Home area				**$76,000**	
TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION IN RENTAL HOME AREA				**$508,000**	

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	PROJECT: Matteo		COMPUTED BY : KK		CHECKED BY: GC
	JOB NO.: 101995.3323.032		DATE : 6/17/2019		DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT: EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

13 - Mira Trucking Remediation

A) Excavation of Mira Trucking

A) Total Excavation/Removal Volume (see table 2-5 in Section 2 of the FS)

Assume 25% volume increase of after excavation

	in-place		excavated	
Lead-contaminated area	**11,200**	BCY	14,000	LCY

B) Production rates

Assume 600 CY/day production rate for excavation of soils.

Assume excavation is performed concurrently with battery casings, sediment excavation, and OFWD.

Assume soils will be transported to the containment cell area.

Excavation duration	19	days

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 1/2 CY	$2,000	per day
Equip. Op. Heavy	$800	per day
Dump Truck (2)	$1,469	per day
Truck Dr. medium (2)	$1,212	per day
Bull dozer	$1,751	per day
Equip. Op. Heavy	$800	per day
Laborer (Semi-Skilled)	$612	per day
Laborer (Semi-Skilled)	$612	per day
Excavation and Waste Segregation Crew Unit Cost	$9,256	per day

Subtotal for Excavation and Handling of Contamimated Soil in Mira Trucking	**$173,094**

B) Post Excavation Sampling $0

Assume one sample per 900 square feet.

Total Excavation Surface Area	151,549	SF
Number of samples for TAL metal analysis	169	

	Quantity	Unit	Unit cost	Extended Cost
Analytical cost	169	EA	$ 120.00	$ 20,280.00
Sampling planning and Sample collection cost	169	EA	$ 200.00	$ 33,800.00
Sample reporting	1	LS	$ 5,000.00	$ 5,000.00
Subtotal for Post Excavation Sampling				**$ 59,080**

C) Offsite transportation and disposal

Transportation and disposal costs

a) Quantity calculation based on data from the RST3 report.

b) Assumes 25% additional volume to account for bulking between bank and loose cubic yards of soil.

c) Assumes 1.6 tons per CY for the materials.

d) Assumes debris to be less than 3'x3'x3'

e) Assumes Subtitle C landfill would be in Ohio (Envirosafe).

CDM Smith
CDM Federal Programs Corporation

PROJECT:	Matteo	**COMPUTED BY :**	KK	**CHECKED BY:**	GC
JOB NO.:	101995.3323.032	**DATE :**	6/17/2019	**DATE CHECKED:**	6/17/2019
CLIENT:	EPA				

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

13 - Mira Trucking Remediation

Type	In-place Quantity (BCY)	Quantity after Excavation (LCY)	Quantity (ton)	Unit Cost	Extended Cost
Lead-contaminated soils	11,200	14,000	18,000	$295	$5,310,000
Total					**$5,310,000**

Labor and equipment costs for loading the truck for offsite disposal
Assume 25 trucks (22 tons) working per day for offsite shipment.

Time for loading the material for offsite disposal			26 days
Excavator, Hydraulic, 2 CY	$1,800	per day	
Equip. Op. Heavy	$800	per day	
Laborer (Semi-Skilled)	$612	per day	
Laborer (Semi-Skilled)	$612	per day	
Total rate per day	$3,824	per day	

Subtotal for labor and equipment **$99,424**

Total for transportation and disposal for Mira Trucking **$5,409,424**

D) Mira Trucking Restoration
Assume backfill including common fill and 6-inches of gravel will be to grade.

Material Costs

Surface area of soils to be replaced		151,549 SF			
Common fill	11,193	LCY	$21	=	$235,053
Gravel	2,807	CY	$30	=	$84,210

Subtotal Material Costs **$ 319,263**

Labor Costs

Backfill and Compaction Labor/Equipment Costs
Assume same labor/equipment costs as OFWD area backfill.

Duration of Backfill 24 day

Total Equipment and Labor for Backfill and Compaction **$ 233,840**

Subtotal for Restoration at Mira Trucking **$554,000**

TOTAL FOR EXCAVATION, SAMPLING, AND RESTORATION AT MIRA TRUCKING **$6,196,000**

Appendix E-4
Cost Estimate for Alternative 5 - Excavation and Offsite Disposal

CDM Smith	PROJECT:	Matteo	COMPUTED BY :	KK	CHECKED BY: GC
	JOB NO.:	101995.3323.032	DATE :	6/17/2019	DATE CHECKED: 6/17/2019
CDM Federal Programs Corporation	CLIENT:	EPA			

Description: FS Cost Estimate for Alternative 5 - Individual Cost Item Backup

14 - Long-term Groundwater Monitoring

Number of monitoring points			20 monitoring points			
Number of samplers			3 samplers			
Number of 10-hour workdays			5 days			
Sampling Project Planning						
Project Manager	4	hr	$150	=	$	600
Engineer	8	hr	$110	=	$	880
Scientist	8	hr	$100	=	$	800
Procurement	5	hour	$90	=	$	450
Field Sampling						
Field Tech 1	100	hour	$85	=	$	8,500
Geologist	50	hour	$110	=	$	5,500
Per diem	15	day	$181	=	$	2,715
Car rental	12	day	$95	=	$	1,140
Equipment & PPE	5	day	$300	=	$	1,500
Shipping	5	day	$300	=	$	1,500
Misc	5	day	$100	=	$	500
Sampling Analysis (includes QC samples)						
VOCs	24	ea	$150	=	$	3,600
TAL Metals	24	ea	$250	=	$	6,000
Reporting						
Project manager	8	hour	$150	=	$	1,200
Scientist	24	hour	$100	=	$	2,400
QA/QC	4	hour	$110	=	$	440
Data validation	24	hr	$150	=	$	3,600
Tabulate the data and prepa	1	LS	$3,000	=	$	3,000
Prepare the data report	1	LS	$5,000	=	$	5,000
Clerk	8	hour	$75	=	$	600
Total Annual Costs for Long-term Monitoring				=		**$49,925**

Present Worth Calculation for Long-term Monitoring Costs

This is a recurring cost every year.
This discount factor is (P/A,i,n)
P = Present Worth
A = Annual amount
i = interest rate 7%
n = number of years 10

$$P = A \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

The multiplier for (P/A) = **7.0**

TOTAL MONITORING COST: **$351,000**